Kenya Colony and Protectorate

Department of Agriculture Annual Report

1931

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DEPARTMENT OF AGRICULTURE
ANNUAL REPORT
1931

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Annual Report of the Department of Agriculture

FOR THE YEAR ENDED 31st DECEMBER, 1931

REPORT OF DIRECTOR *

STAFF, ETC.

The principal staff changes and new appointments are shown in Appendix XI. Notable among them was the retirement, on superannuation, of Mr. A. C. Hunter, who had carried out the duties of Statistical Officer with marked success for a number of years and who had also rendered exceptional service in the capacity of Secretary to the Food Control Board in 1929.

One other officer proceeded on leave pending retirement on pension, Mr. J. Burton, after faithful service as Overseer at the Veterinary Research Laboratory.

The Department has been strengthened by the new appointment of Mr. V. Liversage, as Agricultural Economist, a post of great importance in a properly organized Department of Agriculture, and by the appointment of Mr. G. H. Gethin Jones to the vacant post of Soil Chemist.

At the end of the period under review three posts of Agricultural Officers and one Veterinary Research Officer remained unfilled and in the exercise of economy appointments were not made to the posts of four Stock Inspectors. In addition to the above the following posts were, on account of the financial position, held in abeyance, five Agricultural Officers, one Agricultural Chemist, and two clerks.

ORGANIZATION, ETC.

In pursuance of a desire long felt and a recommendation of the Agricultural Commission, the Department is now organized under two main Divisions: (1) Plant Industry; (2) Animal Industry, and the organization was completed towards the end of the year by the appointment of Major H. H. Brassey Edwards, to the post of Deputy Director (Animal Industy), combining with it the duties of Chief Veterinary Officer. Already there is evidence of the soundness of this organization, though it is inevitable that there should remain a mass of work on subjects of great variety and complexity and ever-recurring demands for special services, which necessitate the personal attention of the Director and his Assistant.

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* NOTE.—The completion of this report has been somewhat deferred on account of some delay in the compilation of the Agriculural Census, chiefly through the absence of a considerable number of owners and occupiers from their farms.

The discharge of services was again seriously interfered with and inevitably hampered by the use of a number of officers on special duty in connexion with the locust campaign. Nevertheless, the reports of the two Deputy Directors, and the sectional reports which follow, disclose a record of work accomplished, which, not only in volume but also in quality, reflect great credit upon the officers concerned and furnish evidence of the value of services rendered by the Department to the agricultural industry. Work, initiated in previous years and consistently pursued up to the limits imposed by the resources available, is now bearing fruit, and the responsible officers of the Department are now able to voice their opinions with some authority based upon work done and experience gained in connexion with the many problems which face the industry in this comparatively new country with complex conditions.

It is to be noted at this point that in order to avoid repetition no attempt will be made in this report to cover the work of the two main divisions of the Department. The administrative side of the Department's activities, the work of its various branches, and the state of the industry as a whole, as revealed during the year, will be referred to, but, in respect to specific services, reference should be made to the other sections of the report covering the Department as a whole.

FINANCIAL.

Statements of Expenditure and Revenue for the fiscal year under review are given hereunder :—

EXPENDITURE	Amount Originally Sanctioned	Amount Expended
	£	£
Administrative and General (including total cost of Headquarters Staff)	14,715	13,762
Expenses, Board of Agriculture and Committees	3,000	970
Grant to Kenya Agricultural Society	500	500
Contribution to Amani Institute	2,028	2,028
Contributions to Imperial Bureaux of Entomology and Mycology	450	450
Contribution to Imperial Scheme for Agricultural Scholarships	647	647
Contribution towards Veterinary Scholarships . .	740	740
Contribution to Colonial Agricultural Service	420	420
Contribution to Imperial Agricultural Bureau	200	200
Contribution to Rowett Research Institute . .	. .	762
Expenses in connexion with Locust Destruction	. .	18,788
Carried forward £	22,700	39,267

EXPENDITURE		Amount Originally Sanctioned	Amount Expended
		£	£
Brought forward	£	22,700	39,267
DIVISION OF PLANT INDUSTRY		18,531	12,833
Subdivisions—			
Native Agriculture		12,349	10,545
Scott Agricultural Laboratories		13,117	11,360
Plant Breeding Services		3,333	3,118
Grading, Conditioning and Cool Stores ..		11,226	6,647
DIVISION OF ANIMAL INDUSTRY		16,655	12,738
Subdivisions—			
Veterinary Services		34,462	31,577
Animal Husbandry		8,638	7,247
Veterinary Research		32,291	28,509
	£	173,302	163,841

In order to meet the requirements of Government for the exercise of economy, reductions were made in Staff and "Other charges", where possible, throughout the vote, and it is to be noted, that notwithstanding the provision of £18,788 for locust destruction, the net actual expenditure of the Department was reduced by £9,461. Noteworthy savings were effected (*a*) under the "Board of Agriculture", arising from the temporary cessation of its activities in April; (*b*) upon the Grading and Conditioning Services in consequence of the shortfall in export of grain, and (*c*) upon "field" Veterinary and Veterinary Research Services consequent upon a reduced demand for veterinary inoculations and for rinderpest serum. Under (*b*) and (*c*) there was a corresponding shortfall in revenue as shown in the following table:—

REVENUE	Original Estimates	Actual Receipts
	£	£
Agricultural Produce, Grading, Conditioning and Cold Storage Fees, etc.	11,995	7,669
Fees from Agricultural Chemical Laboratory..	75	108
Sale of Farm Produce and Stock	500	1,430
Sale of Stores	10	140
Veterinary Inoculation Fees, etc.	18,000	12,116
Sale of Sera, Vaccines and Laboratory Products	12,000	10,476
TOTAL AGRICULTURAL DEPARTMENT.. £	42,580	31,939

An analysis of Expenditure and Revenue is given under the following heads:—

(1) Headquarters, Administration, Staff, etc.

(2) Plant Industry.

(3) Animal Industry.

This statement is exclusive of the expenditure of £18,788 on locust destruction, which was exceptional, and which was not included in the ordinary Departmental estimates.

	1929	1930	1931
	£	£	£
1. (*a*) Headquarters Administration Staff, etc.	19,152	20,939	13,762
(*b*) Expenses of Board of Agriculture and Committees ..	..	1,863	970
(*c*) Grants to Extra-mural Bodies, etc.	6,042	6,963	5,747
Total ..	25,194	29,765	20,479
2. Plant Industry, Administrative ..	..	..	12,833
Subdivisions :			
(*a*) Native Agriculture	13,338	16,703	10,545
(*b*) Scott Agricultural Laboratories	13,358	15,276	11,360
(*c*) Plant Breeding Services ..	3,350	3,447	3,118
(*d*) Grading, Conditioning and Cool Stores	5,776	12,242	6,647
Total Expenditure—Plant Industry	35,822	47,673	44,503
Revenue	7,131	22,320	9,347
Net Expenditure on Plant Industry	28,691	25,353	35,156
3. *Animal Industry, Administrative	..	..	12,738
Subdivisions :			
(*a*) Veterinary Services (" Field ")	55,412	53,023	31,577
(*b*) Animal Husbandry	..	..	7,247
(*c*) Veterinary Research	38,361	37,632	28,509
Total Expenditure on Animal Industry	93,773	90,660	80,071
Revenue	40,542	31,366	22,592
Net Expenditure on Animal Industry	53,231	59,294	57,479
TOTAL NET EXPENDITURE, AGRICULTURAL DEPT... £	107,116	114,412	113,114

*For 1929 and 1930 the figures given relate to Veterinary Services only.

NOTE.—Under (1) it should be observed that certain staff provision, etc. was transferred to (2) and (3) in 1931.

RAINFALL, ETC.

A summary of the rainfall records in representative districts is given in Appendix XII for which acknowledgment is due to the Director of the East African Meteorological

Service. With the exception of some areas to the west of Mount Kenya and in the Coast Province the rainfall was above average, and was well distributed. Conditions were highly favourable for crop production and the growth of pasture. But for damage caused to cereals and grazing by locusts, and to coffee by certain other pests and diseases, the season would have been remarkably good from the point of view of production.

GENERAL.

The phenomenally low prices for all the primary products of the Colony, excepting coffee, continue to cause grave anxiety. Adverse conditions are being faced with fortitude by all sections of the population; producers generally have had to exercise great economy and a lower standard of living due to their financial position and the restriction of credit. Advantages have been gained in so far as steps have been taken in the light of this experience to reduce costs of production to the minimum, though some of those reductions are more apparent than real. The provision of funds under the Agricultural Advances Ordinance has enabled a number of farmers and planters to remain in occupation of their holdings and to continue production, but it is feared that, if a reasonable advance in the prices of export products does not take place shortly, and if the ravages of locusts continue, a number of worthy farmers and planters may be unable to pursue their operations. The case of natives is rather different to that of other producers as little or no cash outlay is involved in their operations, nor have they certain other charges to meet as in the case of enterprises in which capital is employed. Nevertheless, they have also suffered heavily in reduced returns, and where their produce is ordinarily comparatively low in value while transport and marketing costs remain practically constant, the price which can be offered at native markets is sometimes so low that natives are not encouraged even to bring in their produce for sale. Notwithstanding these deterrent factors there is evidence of greater activity in cultivation in the native reserves, partly due to the restriction of income derived from wages as labourers. It may be predicted with some assurance that a reasonable advance in prices will secure a marked increase in the output of produce. Likewise in the case of European farms, producers will be ready to take advantage of improved markets, provided that the prevailing depression does not last so long that they become so crippled financially that they are unable to develop their holdings.

The better organization of marketing of native produce received attention in collaboration with officers of the Administration, and it is hoped that future developments in this connexion will result in increased output and quality of the commodities concerned.

The ravages of locusts caused partial food shortage in the southern portion of the Nyanza Province, but with this exception food supplies were adequate for the needs of the native population. Doubts were expressed as to the adequacy of supplies in parts of the Kikuyu Province were unlimited export allowed, and in these circumstances foodstuffs were conserved by prohibiting export for a period, except under permit.

The collapse in prices of cereal crops impressed upon growers the risks incurred by the single crop system of farming and the endeavours of the Department to stimulate the production of a wider range of crops were continued. Trials of crops on a small scale were extended, and numerous introductions of varieties of crops of economic value were made. These were tried at various centres, and the information obtained was given publicity. To make the production of these crops a commercial success a knowledge of the requirements of oversea markets was essential, and acknowledgement is given to the Imperial Institute and to business firms for assistance rendered in this respect.

For similar reasons the desirability of the more general adoption of dairying in particular has received more attention. Deterrent factors are, however, lack of the capital required for the change of system, and the development of the holding by providing fencing, water supply and dipping facilities, also the losses likely to be suffered particularly in the initial stage from diseases, and the comparatively low productive capacity of such cows as can be procured.

The exportable surplus of butter has been increased. To enable the industry to compete favourably on the European markets, also, to equalize the returns on butter or butterfat to producers, the Butter Levy Ordinance was passed and brought into operation at the end of the year. In view of the increasing output of ghee from native dairies it is desirable that better facilities should be provided for its marketing, and to that end proposals for the appointment of a selling agent for this product are under consideration.

The live stock industry has not suffered relatively so much as certain other branches of farming, not because there has not been a drop in values, both internal and external, but because the outgoings on a live stock holding are proportionately much smaller than on the arable farm or the plantation, and it is noteworthy that stock farmers have incurred commitments on mortgages and overdrafts to a much smaller extent than others.

The maintenance of the fertility of the land is also bound up with the keeping of stock, but as the acreage under cereals is large, the production of animal manure cannot be relied upon entirely for this purpose. In these circumstances investigations into the restoration and maintenance of fertility by means of green manuring and rotation of crops have been extended with the object of ascertaining the most practical and economical methods for the purpose.

The operation of the Fencing and Cattle Cleansing Ordinances is imperative, if advancement is to be made in the cattle industry, and it is to be regretted that on account of the financial stringency Government has been unable to provide the funds which would be necessary, particularly in the case of the Fencing Ordinance. The spread of East Coast Fever in "clean" areas is serious and causes much anxiety, but with the resources available and under existing powers this Department is unable to afford stock-owners greater protection.

Proposals for the erection of a meat factory to absorb surplus and weedy stock in certain native areas have not materialized. Indeed as time passes and in the light of experience, also the market position, doubts are arising to an increasing degree as to the soundness of this method as a solution of the problem.

Pests and diseases caused considerable losses to coffee planters though taking the industry as a whole they cannot be regarded as inordinately high for a plantation crop. While considerable progress was made in the adoption of control measures chiefly as the result of research, much work of that kind remains to be done; in the case of Coffee Berry Disease in particular, difficulties are presented, and several factors have to be taken into account.

Early in the year a request was made by both the coffee and sisal industries for special advances by the Government to planters to meet the necessity for maintaining and developing the plantations of those unable to do so because of the low prices, and the restriction of credit imposed by banks and commercial houses. A committee, consisting of the Director of Agriculture as chairman, with the Treasurer, General Manager (Kenya and Uganda Railways), the Commissioner of Customs and eleven unofficial members representing both the cultural and the commercial sides of the industries, was appointed to inquire into the matter and in the case of both industries recommended that further sums of money should be placed at the disposal of the Agricultural Advances Board for advances to be made to individual planters under the conditions governing the operations of the Board. Unfortunately, the state of Government finances did not permit the recommendations of the committee to be accepted, and it was made known to planters that all that could be done was the consideration of any applications made to the Agricultural Advances Board without preference and within the limit of the funds available.

Towards the middle of the year prices for the superior qualities of Kenya coffee began to improve rapidly and eventually almost reached those obtaining before the depression set in, with the result that planters were able to secure the desired financial accommodation. The sisal industry, however, remains in a precarious position, owing to the protracted period of prices well below the cost of production, and there is no doubt that when the recovery of prices comes the industry will be found to have suffered a severe set back.

Hardly less serious is the position of the grain industries. As in other countries, so in Kenya, the values of maize and wheat on the export markets are considerably less than the cost of production. With the advantage derived from rather higher internal prices, notably in the case of wheat, the average return to the great majority of growers of maize and wheat through the Kenya Farmers' Association, was, for this seasons's crop, that is, up to September, 1931, Sh. 6/19 for maize, and Sh. 9/27 for wheat, in each case per bag of 200 lb.

The locust infestation and the continued reduction in world prices have combined to make the year a particularly difficult one, and it was to be expected that the statistics of production as shown in the Agricultural Census Report of 1931 would have reflected the depressed state of the agricultural industry. The effects are apparent particularly in the reduced acreages and production of cereal crops, and in the greatly reduced values of exports. The total area under occupation also has diminished.

Having regard to the prevailing conditions, however, the figures do not provide ground for undue pessimism and the situation, is not without some encouraging features. Fortuitous circumstances have played a considerable part in the year's results. The locust infestation has been mainly responsible not only for reduced yields of cereals, but for apparent diminution of the area of these crops, since the simplified schedule now in use provides only for areas harvested and leaves out of account areas sown but subsequently destroyed. The yield of coffee shows a considerable reduction from the previous year, but this is merely part of the normal year-to-year fluctuation which is characteristic of the crop. The reduction in sugar production is a consequence of the locust attack.

Among the more favourable aspects disclosed by the figures, it is especially to be noted that the number of occupiers has not diminished, whereas the reduction in average area per occupier is by no means necessarily a retrogressive movement.

The coffee industry, as indicated by areas planted and advancing maturity of plantations, has shown steady progress and there is no reason to regard its position otherwise than with satisfaction. Despite the depressed state of the market the output of sisal fibre has suffered a smaller reduction than might have been expected. Production of tea has shown a very substantial increase. The live stock industry, though showing on the year a somewhat diminished output, due mainly to destruction of grazing by locusts, has nevertheless made steady progress in regard to numbers.

Finally in comparison with the preceding year, it should be remembered that 1930-31 was a record year in several respects in the history of the Colony. Comparisons which appear unfavourable with 1930-31, in several instances appear in a less unfavourable light when the years immediately preceding are taken as the basis of comparison.

Flour Import Duties.

The fall in world prices of wheat which occurred during the year emphasized the difference between internal and external prices and the consequent " loss on export ", also it called attention to the continued importation of flour into the Colony. Government was urged by the wheat growers to raise the customs duty on flour to a prohibitive level, as it was held that price differences had hitherto proved ineffective in overcoming the prejudice of consumers in favour of imported flour.

It became apparent that sales of local flour, the price of which was being maintained at a stable level, were being curtailed in consequence of reduced purchasing power of consumers, while sales of imported flour were maintained as a consequence of reductions in price. Prices of flour and of bread in East Africa were high in comparison with most other countries and views were expressed that consumers should not be called upon to pay excessive prices due to the measure of protection afforded. With the onset of the depression restricting production and the locust invasion, it appeared probable that the export surplus of wheat would be reduced and the average price per bag realized by the producer thereby raised. In all the various circumstances of the case Government decided to assist the wheat industry by the imposition, with the concurrence of the Governments of Uganda and Tanganyika, of an additional suspended duty of Sh. 1/50 per 100 lb., bringing the total duty on wheat flour to Sh. 6 per 100 lb., a rate equal to that in operation prior to April, 1930. It was considered that with this additional measure of protection growers should be encouraged not only to maintain, but to increase production, while with improvements in marketing organization and the supply of flour of the requisite quality to bakers and consumers, the local product should steadily displace imported flour. The suspended duties were put into force on December 4th.

Power Alcohol.

Attention has been devoted to the possibilities of converting surplus agricultural produce of a starchy nature into alcohol for power purposes in the Colony. The progress of schemes with the same object in Southern Rhodesia and the Union of South Africa were examined and in the course of inquiries communication was established with the holder of certain patent rights, who was brought into personal contact with interested organizations in Kenya. As a result of inquiries subsequently pursued in the Colony by the organizations most directly concerned, it is understood that the scheme has been abandoned for the reason that the prospects do not apparently warrant the large capital outlay involved.

Locust Campaign.

Mr. D. L. Blunt, Assistant to Director, who was Officer-in-Charge of the locust campaign, reports as follows :—

After a period of nearly a year of freedom from locusts a new invasion of the Colony commenced in January, 1931; the species concerned being the migratory or " hairy chested " locust, *Locusta migratoria migratorioides.* No previous records of this species in the Colony exist, but from records elsewhere and information secured in Kenya there remains little doubt that swarms were present here about 1895 and 1896. Investigations made by O. B. Lean, in Nigeria, and M. B. Johnson, in the Sudan, indicate that the swarming phase on this occasion probably originated on the upper reaches of the Niger River in 1928, that the sixth generation from the original swarms bred in the Sudan in the latter part of 1930 and that it was the progeny of these swarms that invaded Kenya.

There existed little recorded information as to the habits of this species under conditions similar to those in Kenya, but it was believed that this species was more dangerous to cultivated crops than *Schistocerca gregaria*, the desert locust, which previously invaded the Colony. Events have proved this to be only too true, in that it exhibits a strong preference for plants of the graminaceous family as food .

By the middle of March the incoming swarms had spread over the greater part of the Nzoia and Nyanza Provinces and some of the western and northern areas of the Rift Valley Province. Some damage to crops took place and laying commenced in March, becoming widespread and dense throughout these areas in April and May. The first hatchings were recorded at the end of March. Experiments were then conducted to ascertain whether the baiting method which had proved its value in dealing with the desert locust could be effective and the result proving successful, a campaign was inaugurated based on this method of control. Hatchings continued to increase, as many as six occurring subsequently in a single area and owing to the increased demands from this cause, great difficulty was experienced in maintaining sufficient supplies of bait, in fact supplies were never adequate until June, by which time coffee parchment had been substituted for bran as the basis of the bait. By the middle of June the hopper infestation had been brought under control in some areas, though the Soy, Sergoit and Kisumu–Londiani districts were still heavily infested. Some escapes had occurred, and a definite return movement on the tracks of the parent swarms began to become evident. During the following month this movement became more pronounced, and large numbers of swarms entered the Colony from Tanganyika. By the middle of July the hopper campaign was virtually at an end but large numbers of swarms were present and the damage to cereal crops and grazing caused by these was severe. During the next two months these swarms continued to infest the Colony particulary the Rift Valley and Kikuyu Provinces, and many were present in Akamba. In mid-September an easterly movement was observed and this soon became general, the majority of swarms moving into the lower Tana River area in October.

In mid-November laying was again reported and soon became general east of 37° East Longitude, the lower Tana River, Voi, Kitui, Machakos, Eastern Masai, Meru and North Kenya districts being particularly affected and by the end of the year coastal districts also reported layings. An anti-hopper campaign was again undertaken in all these areas, except the Tana River. The western areas of the Colony remained comparatively free though small layings occurred in South Kavirondo and the Rift Valley.

Organization.

The staff of the Department employed mainly on locust work during the first campaign consisted of the writer, in charge of the campaign; the Entomologist, Mr. Wilkinson, in charge of the Rift Valley and Kisumu–Londiani districts, with the Agricultural Officer and Plant Inspectors in the infested areas assisting, and a departmental officer in charge of the bait mixing station at Njoro. Additionally, five temporary locust officers were employed. With the exception of the above the whole campaign was carried through in settled areas by local voluntary organizations and in native reserves by district officers with the assistance of departmental officers. At a later stage officers of the Medical, Veterinary and Forest Departments assisted, while for the second hopper campaign detachments of the King's African Rifles were made available.

In October His Excellency the Governor appointed a committee consisting of : the Acting Deputy Director (Plant Industry) Mr. D. L. Blunt, Chairman ; the Acting Chief Native Commissioner, Mr. A. de V. Wade ; the Right Honourable Lord Delamere, K.C.M.G. ; Hon. J. L. Cotter, M.L.C., and the Hon. Conway Harvey, M.L.C.—" to advise Government on the best method of combating the locust menace, particularly in respect of concerting Government and private action, native and non-native, and also co-operation with the adjoining territories."

Nine meetings of this committee were held during the last three months of the year, the first two of which were attended by the Director of Agriculture, Tanganyika, and the

Acting Director of Agriculture, Uganda, respectively, and after discussion the policy was agreed between the three territories that each would endeavour to organize anti-hopper measures and carry them out wherever it was possible to secure adequate destruction of hoppers for a reasonable expenditure. At a later stage it was decided that in Kenya expenditure should only be incurred on the destruction of hoppers which were a direct menace to crops and grazing.

On 13th October a proposal was put forward by the committee that Government should offer to purchase dried locusts for stock feed and fertilizer purposes at a rate which eventually became 2 cents per pound and arrangements to do so were thereupon made.

The cost to Government of the first hopper campaign was £14,772 and of the whole anti-locust work during the year £18,788, made up as follows:—

	£
Salaries	1,152
Railway Warrants	1,907
Transport, Lorries, etc. (Petrol, Oil, Repairs, etc...	3,565
Materials (including Gunny Bags, Arsenite, etc...	6,530
Local Transport and Travelling Allowances	2,176
Labour (including Posho, Meat, etc.) ..	1,114
Telegrams and Trunk Calls	127
Hopper Destruction on Unoccupied Farms and Crown Lands	1,218
Locust Scouting	683
Sundries	256
Repairs to Tentage and Camp Equipment..	58
TOTAL £	18,788

Additionally, labour, voluntary in native reserves, and paid by employers in settled areas to an amount which cannot be computed, but which certainly exceeded four million man-days, was used. At a low computation, this represents a labour value of at least £70,000.

The voluntary work of a large number of Europeans must also be taken into account, also the use of the King's African Rifles.

Although the measures adopted during the first six months of the year did not prevent a very heavy infestation by flying swarms in the second six months, and losses of crops, which have been estimated to exceed £250,000 together with very serious destruction of grazing, yet in the whole area infested in that period it is believed that not less than 80 per cent of the hoppers were destroyed. It has been observed that local escapes in the early stages are more voracious than locusts at any other time, also such local escapes attack crops at an earlier stage than older swarms entering a district. There is every justification therefore to suppose that the expenditure of £18,788 referred to above did in fact save crops and grazing to a value of many times that amount and more than one competent observer has estimated that loss of crop equivalent in value to the whole cost of the campaign has been prevented by the measures taken in a small area.

Agricultural Economics.

The need for systematic work on the economic side has been realized for a considerable time and the Department was placed in a position to begin this important service by the appointment of an Agricultural Economist at the beginning of 1931.

The work of the section comprises, in brief, investigation into and advisory work on the economic side of all sections of the agricultural industry, and includes both the production and the marketing aspects. The keynote of the work is increase of economic effectiveness as regards the ways and the directions in which productive effort are applied. Before the various problems can be effectively attacked it is necessary to accumulate quantitative data, in a more intensive manner and over a wider field than is covered in the Annual Agricultural Census. For much of this work the co-operation of those engaged in the industry will be necessary, and it is very gratifying to be able to record that in the investigations so far pursued the most willing assistance has been forthcoming.

The institution of the section of Agricultural Economics coincided with the period of steepest fall in world prices which marked the course of the depression. The rapid fall in export values rendered necessary the closest attention being given to the development and use of the natural sources of wealth of the Colony, in order to arrest as far as possible the decline in the Colony's purchasing power. After a close inquiry attention was called to the importation from overseas of food materials which could be produced within the Colony. A widespread movement in favour of Kenya produce has eventuated, and, perhaps, in part due to this movement as well as to decline in purchasing power, the value of foodstuffs imported in 1931 declined by some 30 per cent as compared with 1930.

The possibilities of attacking new markets were investigated and attention was called to the fact that the various territories bordering the Indian Ocean offered potential markets for large quantities of perishable produce, the demand for which was supplied largely by areas as far distant as Southern Europe and Australia. In particular it was seen that potential markets exist in Ceylon, India, the Sudan and other areas for greatly augmented supplies from Kenya. The methods and costs of marketing potatoes and probable returns were investigated and the resulting information embodied in a bulletin which was issued by the Department.

The possibility of developing an export trade in eggs has also received attention, in relation both to high-grade eggs and to eggs of the common standard of native produce. A bulletin dealing with the probable returns, the costs of marketing and the organization necessary for extensive marketing has been compiled in collaboration with the Live Stock Officer, and was issued early in 1932.

In regard to the export trade in the products mentioned above an obstacle is the cost of ocean transport. Within the last two years general increases have occurred in freight rates on potatoes and though, following representations made by this Department, the original increases were somewhat reduced, consignments from Southern Europe still enjoy a substantial advantage. In the case of eggs, also, considerable reductions have been quoted on representations from this Department, but still greater reductions will be necessary before Kenya can compete on level terms with other areas even more distant from European markets. Shipping companies hesitate to quote rock-bottom rates on commodities the exports of which are of small volume, and, on the other side, producers cannot afford to undertake development without some assurance that the way will not be blocked in the future by transport costs higher than the traffic can bear.

Field investigations into the methods by which native produce is marketed have been conducted in the Kikuyu Reserve, and have provided preliminary data for the initiation of organized schemes of marketing. The products covered so far have included potatoes, maize and wattle barks. It is hoped to extend these studies to other products and areas, particularly to oilseeds in the Nyanza Province.

Side by side with marketing investigations a beginning has been made with production studies. The disorganization consequent upon the rapid fall in prices and the locust infestation has multiplied the difficulties of investigation with cereal products and sisal, and attention was given to coffee. An economic survey of a selected area in Kiambu has been carried out and the data obtained has been subjected to statistical analysis. A bulletin has been prepared analysing and comparing costs of production, reviewing the present organization of the industry and discussing the lines along which future progress is likely to lie.

It is hoped to extend such productive studies to other branches of the agricultural industry, particularly to sisal, dairying, and various systems of mixed farming, and thereby to assist in establishing principles of economic farm organization, applicable to the particular circumstances of differing areas in the Colony.

It would appear from preliminary observations that an aspect offering special scope for useful investigational work is the methods of organizing and carrying out particular farm operations by native labour. Owing to the superficial appearance of cheapness of native labour the subject has not generally received close attention in the past. But with the increasing severity of the struggle for economic existence no avenue of economy must be left unexplored by the agricultural industries in the Colony, and it seems not unlikely that the accurate recording and study of data on the outturn of effective work under different methods of labour organization and equipment will produce results of very material value.

The opportunity was afforded of combining the "Agricultural Economics" and "Statistics" sections under one Head—the Agricultural Economist—thus securing the greatest economy and efficiency.

Agricultural Statistics.

The twelfth Agricultural Census, for the year, 1st March, 1931, to 29th February, 1932, has been completed and will be published with this report.

For purposes of reviewing the state of the agricultural industry, free use has been made in this report of data obtained from the Agricultural Census Report. For detailed information reference should be made to the latter.

Crop Reports.

The revised system of forecasting crop production and exports, inaugurated in 1928, was continued during the year with satisfactory results.

The number of crop correspondents, who assisted in this service by submitting monthly estimates, rose to 283.

Crop forecasts were published for the months of January, February, July, August, September, October, November and December.

The thanks of the Department are due and tendered to the crop correspondents who regularly submitted monthly estimates, and by so doing enabled the Department to maintain this service, valuable alike to Government, Railways and Harbours Administration, shipping companies, trade and commerce, agriculturalists and the public generally.

IMPORTS—KENYA AND UGANDA.

		1931	1930	1929	1928	1927
QUANTITY						
Wheat	cwts.	2,996	2,742	2,847	3,754	2,904
Wheat Meal and Flour	,,	66,844	64,037	68,605	64,742	63,843
Ham and Bacon ..	,,	35	114	60	93	124
Butter	lb.	2,576	4,592	17,136	16,464	6,832
Cheese	,,	13,664	11,312	31,920	29,344	18,032
Ghee	cwts.	5,813	6,553	8,910	8,986	10,475
Condensed Milk ..	,,	11,434	13,246	14,018	12,170	8,531
Sugar	,,	6,566	34,891	48,029	80,244	9,623
Tea	,,	1,341	3,788	8,094	8,897	7,273
VALUE.						
		£	£	£	£	£
Wheat		1,638	2,171	2,530	3,227	2,694
Wheat Meal and Flour ..		36,684	49,158	58,644	57,231	58,739
Ham and Bacon ..		313	398	710	848	1,253
Butter		223	460	1,565	1,624	675
Cheese		1,228	1,117	3,146	2,968	1,780
Ghee		14,891	21,634	37,164	36,372	46,832
Condensed Milk ..		23,807	31,839	40,310	39,115	27,321
Sugar		6,388	23,791	38,576	68,903	10,661
Tea		11,621	34,798	73,508	81,913	69,567
TOTAL ..	£	96,793	165,366	240,153	292,201	219,477

In considering this Schedule due regard should be given to the increase in population.

Imports.

The foregoing table gives particulars of the imports into Kenya and Uganda of certain products. The statement is of importance in relation to the development of the agricultural industry, the markets for, and the extent to which they remain unfilled by local produce.

Despite the fact that adequate supplies of Kenya-grown wheat were being offered in the Colony throughout the year, importation of wheat flour and meal continued on a large scale. In addition to 57,449 cwt. imported into Kenya, 9,393 cwt. were imported into Uganda. Railway statistics show that 29,480 cwt. was railed from the Coast to up-line destinations, including Uganda. It would therefore appear that 27,969 cwt. were consumed at the coast and 20,087 cwt. in other parts of the Colony.

It will be seen that for all practical purposes this Colony is self-supporting in respect of ham and bacon, butter and cheese. Such quantities as are imported consist chiefly of tinned goods for special needs, e.g., safari requirements. The ghee is imported chiefly from Tanganyika. For the manufacture locally of condensed milk, special conditions are required, and the position should be reviewed, as opportunities may occur, for the establishment of a factory in a suitable locality where a sufficient supply of fresh milk is assured. Imports of sugar have varied greatly during the last few years, but for the past four years have shown a steady decline.

Locally produced tea has steadily displaced the imported article and the Colony now produces a substantial quantity, surplus to the requirements for local consumption, and an export trade is in process of development.

Those engaged in the sugar and tea industries realize the importance of developing the local market, notably among non-European consumers, and this has been stimulated by a substantial reduction in prices. A selling organization, established for the sugar industry, has been markedly successful, but in the case of tea the absence of agreement has brought local prices for this product to a point below its cost of production. With a return to prosperity and greater purchasing power, in particular of natives, an ever-increasing demand for sugar and tea should follow, but there will remain a surplus for export and in the interests of all engaged in these industries the position and the course of development will require to be carefully watched, and it may become necessary to safeguard majority interests, and the interests of the Colony generally, against those who seek to take undue advantages.

Exports.

The total value of agricultural exports, the produce of Kenya, in 1931, was £2,057,297, a decrease of £1,051,110. A large part of this decrease, namely, £440,548, is accounted for by coffee. It is to be noted that the decrease of exports was only 18.8 per cent in tonnage, compared with 33.8 per cent in value. This comparison reflected the recent downward movement in world prices. The quantities exported during 1931 were actually greater than in any year except 1930, during which the tonnage was abnormally heavy due to a large export of maize.

As statistical data of native agricultural production are not available, the particulars given in the succeeding sub-sections of this report apply only to agricultural development by Europeans.

Acreage, Occupation and Development.

The total area allotted for occupation by Europeans is approximately 7,524,480 acres, of which an area of about 281,920 acres is still available for alienation. Of the area allotted, 5,199,903 acres are under occupation, showing a decrease of 116,390 acres as compared with the preceding year. The number of European occupiers totals 2,107, a net increase of one over the previous year, but it is calculated that changes of occupiers took place on 64 holdings, making the number of new occupiers 65.

The number of Europeans employed on agricultural holdings, inclusive of the occupiers, is returned at 2,822, an increase of 47 as compared with the previous year.

The total area under cultivation is 613,557 acres, giving an average of 291 acres per occupier, as compared with 309 and 306 acres for the years 1930 and 1929 respectively. Including land used for stock farming, it is calculated that the area beneficially occupied is, on the average, 1,336 acres per occupier, which shows the extensive character of farming operations in the Colony.

In addition, considerable areas of farms are used by native squatters and employees.

The following table shows the ratio of acreage under cultivation to total area occupied :—

Year	Total Occupied Area	Total Cultivated Area	Total area under arable crops during the year	Total area cultivated but not cropped during the year	Percentage cultivated to occupied land as at 28th February	Percentage cropped to cultivated land	Percentage fallow
*1932	5,199,093	613,557	519,387	94,170	11·80	84·65	15·35
*1931	5,315,483	650,965	572,339	78,626	12·25	87·92	12·08
†1930	5,111,161	643,644	564,145	79,499	12·59	87·65	12·35
†1929	5,000,648	635,590	570,171	65,419	11·40	89·69	10·31
†1928	4,896,406	592,741	525,421	67,320	11·81	88·64	11·36
†1927	4,737,920	512,543	438,035	74,508	10·82	85·46	14·54

*As at 28th February. †As on 31st July.

PLANT INDUSTRY.

Embraced in this Division are the following sections: Native Agriculture (Field Husbandry) including training schools; Scott Agricultural Laboratories, including chemical, botanical, entomological, grass land improvement and experimental work; coffee; plant breeding at Njoro and elsewhere; plant inspection, grading and inspection (imports and exports), grain conditioning and cool stores.

Marked progress has been made by the officers of this Division in dealing with problems affecting the industry. Through experience gained and from the results of research and experimental work, they are now in a position to give sound advice, and it is gratifying to be able to record that great use is made of their services and reliance placed upon their opinions. Again in regard to native agriculture the best methods to adopt in organizing the service are gradually becoming clarified, in the light of experience gained, and good results are being achieved.

As already explained, it is not intended under this head to make more than an abbreviated statement, as full particulars of the work of the Division are given in the report of the Deputy Director (Plant Industry). It will be convenient, however, to place on record, as follows, a list of the subjects being dealt with under *Research and Experimental Work* :—

Entomology.

Locust control investigations.

Leaf-eating caterpillars of coffee and their natural parasites.

Further investigation into the incidence and bionomics of Antestia (Coffee Bug) and Lygus (Capsid): distribution of the various species.

The control of Antestia and Lygus with special reference to the elaboration of the pyrethrum-paraffin method of control.

Continuation of the work on " Coffee mealybug "; bionomics: repellent banding against attendant ants.

A more intensive study of ant control.

Introduction of predators and specific parasites of *Pseudococcus lilacinus* in collaboration with the Imperial Bureau of Entomology.

Agricultural Chemistry.

The relation between soil conditions and the incidence of coffee berry disease with the object of ascertaining why the berries are attacked and if there is some predisposing soil condition capable of easy correction.

Essential oils for the development of the industry.

Nutritional deficiencies of coffee soils for the development of a simple observational technique.

Optimum soil acidity for coffee on Kikuyu red loams.

Preliminary study of the rate of nitrification of nitrogenous manures in the field and in lysimeters, and the movement of nitrates.

The nature of the clay fraction in the Kikuyu red loams to ascertain the basal character of soils of this nature.

Long-range general survey of main soil types of the Colony.

Study of the rate of downward movement of phosphates and the fate of phosphates under various soil conditions.

Study of the effect of variation of commercial methods of fermentation upon the quality of coffee.

Investigation of Kresotow and banding greases used in the control of " Coffee mealybug."

Mycology.

Experiments on control of coffee berry disease, nutritional, fungicidal, cultural.

Investigation on connexion between coffee bean disease and Antestia attack.

Continuation of search for physiologic forms of stem rust of wheat.

Experiments on treatment of " black chaff ", *Bacterium translucens*, var. *Undulosum*, disease of wheat.

Investigation of " Take-All ", *Ophiobolus graminis*, disease of wheat.

Fungi associated with root disease of wheat studied especially in relation to their association with similar disease in maize.

Studies and experiments on the possible relationship between a rust on indigenous barberry and stem rust of wheat.

Investigation of ear and root rots of maize in relation to the work of the Plant Breeding Station.

Determination of cause of two basal rots of sisal.

Investigation on gumming disease of coco-nuts and nut-fall at the Coast.

Experiments on seed treatment of barley against covered smut.

Test of the possibility of maintaining potatoes in virus-free condition in the field in certain areas of the Colony.

Study of bacterial blight disease of beans.

Identification of the fungus causing disease in locust swarms and investigation of methods for its dissemination.

Investigation of a wilt disease of groundnuts at the Coast.

Black chaff disease of wheat. The efficiency of wet seed treatments.

Functional resistance to black stem rust of wheat, studying the Canadian resistant and susceptible Njoro varieties.

Investigations of temperature and humidity relations in connexion with incidence of yellow rust of wheat.

Mass infection of stem rust of wheat in breeding cages.

Maize smut rotation experiment.

Continuation of seed treatment against barley smut.

Plant Breeding.

Wheat and maize breeding at Njoro, Scott Agricultural Laboratories and Kitale. Production of (*a*) rust resistant wheats; (*b*) disease resistant maize; (*c*) early maturing maize; this section also embraces manurial and variety trials on crops, improvement of crop yields, etc.

Grassland Improvement.

Palatability experiments on indigenous grasses.

Sampling of indigenous herbage species for determination of nutritive value by means of chemical analysis.

Establishment of experimental plots to determine periodicity of yields of herbage and nutrients.

Experiments to ascertain the effects of burning and different intensities of grazing on natural pastures.

Preliminary work to determine seeding qualities of indigenous species.

Observational plots at various centres to obtain information on the behaviour of the more promising species under varied soil and climatic conditions.

Coffee.

Vegetative propagation.

The effect of spraying coffee trees with Bordeaux Mixture.

Manurial treatments.

Pruning and establishing coffee on single-stem and multiple-stem systems.

Monthly stumping trials.

Green manure and cover crop variety trials in coffee.

Fermentation tests.

Liquoring tests of the different varieties.

Establishing a large range of series from selected plants of different varieties.

Introduction of imported varieties.

Making compost manure from cultivated perennial plants.

Coffee berry disease investigation.

Observations on manurial trials in connexion with mealybug.

Shade tree trials.

At Scott Agricultural Laboratories (additional work on coffee and wheat breeding) :—

Improvement of Muratha maize by selection.

Potato variety trials, storage trials and general observations.

Lucerne variety trials.

Trials with a large number of introduced crops and plants.

Establishing a number of essential oil plants for the Senior Agricultural Chemist.

Green manure experiment. Application of fertilizer to green manure crop rather than to following cereal crop.

Rift Valley Province (at three centres) :—

Investigation of growth of suitable green manures between rows of maize.

Large scale green manure trials.

Investigation of sowing wheat in April, harvested in September, followed by green manure planted in October, followed by a cereal planted in the succeeding season.

Legume trials for both cropping and green manure.

Duration of beneficial effect on soil of a green manure crop.

Variety and spacing trials with crops of possible economic value.

Underplanting wheat with varieties of Lespedezas.

Quantitative lime experiment.

Trials of phosphates in connexion with root and stem rots of maize.

Trans Nzoia Province (at five centres) :—

Green manure rotation experiment.

Trials of green manuring crops.

Variety trials of economic crops.

Trials of green manure crops for interplanting with maize.

Green manure alone as against green manure and lime.

Quantitative lime experiment.

Phosphates applied to the green manure as against application to the following maize crop.

Pasture and forage crop trials.

Trial of Tung Oil.

Trials of suitable trees, etc., for coppicing for pea and bean sticks.

Note.—Some of the experimental work enumerated above is done on private holdings in co-operation with farmers.

Native Reserves.

Coast (at Kilifi) :—

Variety trials with food crops.

Trials of green manures and cover crops, including some indigenous leguminous plants.

Planting-time tests of local varieties of cotton and tests of varieties obtained from Uganda.

Trials of introduced crops of possible economic value.

Nyanza (at Bukura and Kisii) :—

Variety trials of food crops.

Green manure and cover crop trials.

Kikuyu (at Scott Agriculutral Laboratories) :—

Demonstration small-holding.

Mixed (native method) versus separate (European method) of planting of native food crops.

Trials of introduced crops of promising economic value.

PUBLICATIONS.

Bulletins and Press articles, etc., issued from the Division of Plant Industry were as follows :—

General.

Preliminary Report on Crop Experiments, 1930 (Bulletin No. 14/1931).

Essential Oils. Methods of Production and Possibilities in Kenya; by V. A. Beckley, M.C., M.A., A.I.C., Senior Agricultural Chemist (Bulletin No. 19/1931).

Investigation of Diseases (plant) at the Coast.

Notes on the Cultivation of Onions, Niger Oil, Edible Canna, Kudzu Vine, Sunflowers and Groundnuts.

Coffee.

The Yellowing of Coffee; by V. A. Beckley, M.C., M.A., A.I.C., Senior Agricultural Chemist (Bulletin No. 3/1931).

Soil Conditions Affecting Coffee in Kenya; by D. S. Gracie, B.Sc., (Hons.Edin.), A.I.C., late Assistant Agricultural Chemist, and A. D. le Poer Trench, Senior Coffee Officer.

Coffee Growing in the Trans Nzoia; by V. A. Beckley, M.C., M.A., A.I.C., Senior Agricultural Chemist, and A. D. le Poer Trench, Senior Coffee Officer.

Some Symptoms of Plant Nutrient Deficiencies in the Coffee Tree; by V. A. Beckley, M.C., M.A., A.I.C., Senior Agricultural Cheimst. (Published in the Journal of the East Africa and Uganda Natural History Society, No. 30-39, 1931.)

Coffee Berry Disease (Mycological Leaflet No. 4).

Brown Blight of Coffee Berries (Mycological Leaflet No. 5).

Coffee Leaf Disease or Rust (Mycological Leaflet No. 6).

Coffee Dieback (Mycological Leaflet No. 7).

Root Diseases of Coffee, Tea and other Woody Plants (Mycological Leaflet No. 8).

Antestia Bug on Coffee.

Control of Capsid Bug on Coffee.

Scorching of Kerosenes.

Maize.

Ear Rots and Root Rots of Maize in Kenya and Some Suggestions for their Control; by Colin Maher, B.A. (Hons.), Dip.Agric. (Cantab), A.I.C.T.A. (Trinidad), Agricultural Officer (Bulletin No. 5/1931).

Improvement of Maize Yields in Kenya Colony; by G. J. L. Burton, M.C., B.A., Senior Plant Breeder, and Colin Maher, B.A.(Hons.), Dip.Agric. (Cantab.), A.I.C.T.A. (Trinidad), Agricultural Officer (Bulletin No. 6/1931).

The Control of the Cutworm; by H. Wilkinson, A.R.C.Sc., F.E.S., F.L.S., Entomologist (Bulletin No. 12/1931).

Head Smut of Maize (Mycologcial Leaflet No. 9).

Leafblight of Maize (Mycological Leaflet No. 10).

Treatment of Maize Stalk Borer.

Wheat.

Investigations on Stem Rust of Wheat in Kenya Colony; by J. McDonald, D.F.C., B.Sc.(Hons.), F.L.S., Senior Mycologist (Bulletin No. 1/1931).

Root Rot, Foot Rot and Head Blight of Wheat in Kenya; by H. J. Taylor, S.E.A.C. (Dip.Hons.), Agricultural Officer, and Colin Maher, B.A.(Hons.), Dip.Agric. (Cantab.), A.I.C.T.A. (Trinidad), Agricultural Officer (Bulletin No. 4/1931).

Potatoes.

A bulletin on the Potato; by S. Gillett, S.E.A.C. (Dip.Agric. and Vety.Sc.), Agricultural Officer (Bulletin No. 10/1931), with Notes on Diseases and Pests by the Senior Mycologist and Senior Entomologist respectively.

Powdery Scab of Potatoes (Mycological Leaflet No. 2).

Early Blight of Potatoes (Mycological Leaflet No. 3).

Locusts.

Report on the 1931 Locust Invasion of Kenya (Bulletin No. 21/1931).

Smudge Fires for Protection against Locusts.

The Manurial and Feeding Value of Dried Locusts.

In addition to the above, two leaflets in Ki-Swahili were issued on the following subjects :—

Do's and Dont's for Native Agriculture.

The Growing of Vegetables.

MAIN CROPS.

The total area under crops during 1931-32 was 519,387 acres and the total area under cultivation 613,557 acres. For comparative purposes particulars of acreages of the main crops for the previous years are given, together with percentages of increase and decrease, in the following table :—

	1931–32	1930–31	Increase	Decrease
	Acres	*Acres*	*Per cent*	*Per cent*
Maize	160,546	200,126	..	20·0
Wheat	43,168	68,851	..	37·3
Barley	2,330	1,967	18·4	..
Coffee	98,874	96,689	2·2	..
Sisal	145,660	137,299	6·0	..
Tea	11,258	10,052	11·9	..
Coco-nuts	8,121	8,499	..	4·4
Sugar Cane	12,363	13,493	..	8·3
Wattle	13,308	11,702	13·7	..
Essential Oil Plants ..	1,859	1,683	10·4	..

Maize.

The figures quoted above show a decrease of 40,380 acres or 20 per cent on the previous year. It should be noted that the simplified schedule now in use for purposes of the Agricultural Census provides only for the area harvested and does not include areas planted but subsequently destroyed by locusts or other causes.

The following table showing the acreages and yields of maize in past years is of interest :—

MAIZE AREAS TOTAL YIELD AND AVERAGE YIELD PER ACRE OVER A PERIOD OF 13 YEARS

YEAR	Acreage Harvested	Total Yield	Average Bags per Acre
		Bags	
1919–20	32,167	317,525	9·87
1920–21	30,846	164,722	5·34
1921–22	57,131	338,837	5·93
1922–23	74,747	517,877	6·93
1923–24	108,556	833,640	7·68
1924–25	129,647	893,108	6·89
1925–26	155,751	926,614	5·95
1926–27	177,987	1,314,643	7·39
1927–28	177,009	1,088,706	6·15
1928–29	204,945	1,099,317	5·36
1929–30	233,973	1,858,586	7·94
1930–31	200,926	1,649,728	8·21
1931–32	160,546	762,622	4·75

The average yield over the Colony was 4.75 bags per acre, as compared with 8.21 bags in the previous year, due mainly to the damage caused by locusts.

The season was generally a favourable one for maize. Diseases were not so prevalent as during the previous year and, but for the considerable loses caused by locusts, heavy yields would have been obtained. With the continuation of the depression, a further slump in export prices occurred, reaching bottom at about Sh. 3 per bag f.o.r. seller's station, greatly below the cost of production. The 1930-31 crop promised a surplus of 200,000 bags only compared with over one million bags from that of 1929-30. A gradual improvement in prices was noted during the early months, and owing to rumours of internal shortage one or two sharp fluctuations in prices occurred. As the surplus from the 1930-31 crop was small the internal price increased, until at the end of the year it had risen to Sh. 9/75. This was well above the price to be obtained by export, but still below import parity.

The Railways and Harbours Administration has closely examined the position in regard to the flat maize rate for maize exported and as the result it has been decided that the rate should be increased by Sh. 2/30 per ton to bring the average rate earned up to approximately Sh. 15 per ton, including branch line rates. In addition proposals have been made for allocating the monthly tonnage of maize traffic for export, so that it may be moved without incurring excessive additional expenditure. It was found that these proposals would seriously hamper the industry, and in fact that they imposed conditions under which the industry could not survive. At the end of the period under review they were still under examination.

With a continuation of low prices, growers directed their attention to lowering costs of production per acre to a minimum, not only by exercising economies on the farm, but by securing heavier yields. Much solid investigational work is being conducted by the field and specialist staff of the Department towards the improvement of the permanent fertility of the soil at low cost, also to the production of higher-yielding, disease-resistant strains, and cultural methods whereby higher yields may be obtained at no additional expenditure. Notable as a means towards effecting this improvement was the Seed Maize Competition organized by this Department in conjunction with the Royal Agricultural and Horticultural Society.

Wheat.

The area harvested was 43,168 acres, a decrease of 25,683 acres from the preceding year. The average yield was only 2.01 bags per acre, due in no small measure to damage by locusts. The total production was 86,862 bags. This is considerably below the probable requirements for domestic consumption and importation of wheat will be necessary if mills in the Colony are to retain their trade connexions.

The acreage harvested and the production in each of the past five years is shown in the following table :—

YEAR	Acreage Harvested	Total Production
	Acres	*Bags*
1927–28	75,102	173,958
1928–29	82,951	223,141
1929–30	63,217	293,468
1930–31	68,851	194,337
1931–32	43,168	86,362

The above table shows the acreage under wheat in 1931 was reduced by some 25,000 acres below that planted the previous year. The apparent reduction is partly due, as in the case of maize, to the fact that the areas planted but subsequently desrtoyed before the harvesting stage, are not recorded in the simplified schedule now in use. Contributory factors were an undue incidence of rust and other diseases and the uncertainty of the wheat market. The price factor becomes extremely important when the farmer takes into consideration the risks of growing this crop.

Whilst the 1931 season was generally an average one and suitable for the production of good yields of wheat the great reduction in average yields was due largely to locusts. At the higher altitudes a disease known as " Take All " was responsible for a further reduction in yields and " Black Chaff " took a further toll. " Take All " is now regarded as a major disease, and was prevalent during the year. It is being investigated by one of the mycologists, and it is expected that it will shortly be possible to recommend preventative measures.

The export of wheat decreased from 214,527 cwt. in 1930 to 63,644 cwt. in 1931. The corresponding values were £91,447 and £15,313. In addition, 28,082 cwt. of wheat flour, valued at £20,263, were exported, chiefly to Tanganyika, while 21,166 cwt., valued at £18,684, were consigned to Uganda.

Statistics of wheat milling operations were called for in respect of the period 1st March, 1931, to 29th February, 1932. 117,183 bags of wheat were milled and produced, 35,198 bags fine flour and 49,621 bags "Atta." The loss in milling (bran, pollards, etc.) averaged 27.6 per cent. Nineteen mills, capable of milling a total of eighty-eight bags of wheat hourly were in operation during the year. This is an increase of eight over the number of mills in 1930. The increase, however, consists entirely of small local mills with a capacity of from half a bag to four bags per hour. Only seven mills out of the total in the Colony have a capacity of over six bags per hour. The increase in small mills without efficient milling machinery and equipment is not a desirable movement.

The Sale of Wheat Agency, acting on the advice of the Wheat Advisory Board, disposed of farmers' deliveries to local mills and for export. To local mills prices ranging from Sh. 17/50 down to Sh. 6 were fixed according to grade and quality. In respect of wheat milled for coastal and other markets rebates were allowed ranging up to Sh. 10 per bag. In all, rebates were allowed on 12,837 bags, the total amount remitted being Sh. 102,541/56, equivalent to cents 64 per bag over the whole of the " pool delivery." As a result of the whole of the operations of the Agency the net returns received by farmers for wheat delivered ranged from Sh. 10/90 per bag down to Sh. 3/65, according to grade and quality.

Barley.

The area of barley harvested was 2,330 acres, as compared with 1,967 acres in 1930-31. The total production of grain amounted to 7,126 bags as compared with 10,215 bags in the previous year. The reduction in output is proving a matter of concern to pig feeders in the Colony.

Coffee.

An increase is again recorded in the area planted with coffee and the total area is now returned at 98,874 acres, an increase of 2,185 acres over the previous year. The quantity of clean coffee produced was 170,091 cwts., a decrease of 80,828 cwts. or 32 per cent from the record created in the previous year. 245,991 cwts. of coffee, valued at £986,988 were exported during 1931, as compared with 310,168 cwts., valued at £1,427,536 in 1930.

The following were the monthly average prices per cwt. for Kenya coffee in London during the year 1931 :—

	Sh.	*d.*		*Sh.*	*d.*
January	79	4	July	54	6
February	82	9	August	51	8
March	77	11	September	58	7
April	73	3	October	73	6
May	56	6	November	80	3
June	54	0	December	94	9

From May onwards there was a continuous decline in prices until Great Britain came off the gold standard, when the prices steadily increased. The average price for the year was Sh. 74 per cwt.

A desire has been evinced by the coffee trading interests in Nairobi to expand their operations in order to include coffees from neighbouring East African territories, involving the entry of larger trade samples and investigation into treatment of bulk consignments for destruction of pests. These inquiries were well advanced at the end of the year.

Pests and diseases have as usual taken their toll of the crop, and among the worst may be mentioned, mealybug, Antestia, Capsid (*Lygus simonyi*) and Coffee Berry disease. Reference to these will be found in the reports of the Entomological and Botanical sections.

A bill to establish a Coffee Board for the advancement and control of the industry, mainly connected with improvement of marketing and the expansion of markets, was published for general information in April, 1931, but was not found acceptable to the Coffee Planters' Union. At the end of the year the proposals again came under review and it is hoped that agreement may be reached.

The Annual Report of the Coffee section will be found in Appendix V.

Sisal.

A further increase in the area under sisal is recorded and the total now stands at 145,660 acres. The area under three years, however, declined by 13,108 acres or 19 per cent as compared with the previous year while that over three years increased by 21,469 acres or 31 per cent. This change reflects the condition of the industry due to the depressed state of the market, and indicates that new planting is not being continued on the same scale as formerly, and mature sisal is remaining uncut.

Production of fibre at 14,674 tons shows a reduction of 4,184 tons as compared with the output in the previous year. Exports of fibre during 1931, on the other hand, increased by 45 tons over the 1930 level and amounted to 15,994 tons. The average value of sisal, as declared in the trade returns, fell from £27/10s. in 1930 to £14/5s. in 1931. The value of sisal fibre of all grades continued to decline, and by the end of the year production had been discontinued on numerous estates. The setback experienced by the industry was not fully reflected in export figures for the year, as considerable quantities prepared in 1930 were not exported until 1931. This industry has had to rely entirely upon oversea markets, but should the proposal to manufacture sisal bags within the Colony materialize, and should such an industry reach considerable dimensions, great benefits might be derived.

The proposed joint investigational work by Tanganyika and Kenya with the Amani Research Station is suspended until the financial circumstances of the industry, and the two Governments, have improved. The Amani Research Station, however, is continuing its "long range" investigational work, though this will be hampered by lack of certain data which the field stations were to provide.

The engineering investigations by private interests into the possibility of a greatly increased percentage of fibre extraction at a lower cost has now reached an advanced stage and is being supported by the Colonial Development Advisory Committee. It is expected that the improved machine will be in experimental operation in the Colony in 1932.

Tea.

This industry is now well established, both in the Kericho and Limuru areas. The area under tea increased to 11,258 acres, from 10,052 acres in 1930. The production of "prepared" leaf increased from 930,209 lb. in 1930-31 to 1,500,249 lb. in 1931-32. The industry has now succeeded in supplying the domestic demand to a large and ever-increasing extent and provides an appreciable surplus for export. The net exports in 1931, including consignments to Uganda, amounted to 480,848 lb.

Sugar Cane and Sugar.

Both acreage of sugar cane and production of crystallized sugar decreased in the year under review, the latter reflecting the damage caused by locusts. The area under cane decreased by 1,130 acres to 12,363 acres and the production of crystallized sugar by 77,120 cwts. to 104,700 cwts. The amount of crystallized sugar exported from the Colony on the other hand increased from 15,047 cwts. in 1930 to 21,196 cwts. in 1931. Imports of sugar into the Colony decreased from 34,650 cwts. in 1930 to 6,360 cwts. in 1931. The apparent decrease in domestic consumption is accounted for by increased supplies obtained from Uganda.

As no Mosaic disease had been found during inspections subsequent to December, 1929, the restrictions on the growing of susceptible varieties of cane in the Nyanza Province were allowed to lapse from June, 1931. Growers, however, were advised, at least for the present, to restrict their plantings to resistant varieties and, as an encouragement to do so, free issues of certain highly resistant P.O.J. varieties, multiplied at the Scott Agricultural Laboratories, were made to planters. A few cuttings of the susceptible BH 10/12 variety were issued in June for planting in a nursery at Muhoroni as a test for mosaic. These have so far remained completely free from the disease.

The East African Sugar Distributors, Ltd., amalgamating—with one exception—all the larger manufacturers in Kenya and Uganda, is now in operation, and it is anticipated that this amalgamation will enable measures to be carried out for the benefit of the industry, without detriment to consumers.

Coco-nuts.

The acreage under coco-nuts declined slightly to 8,121 acres as compared with 8,499 acres in 1931. The output of copra, on the other hand, increased to 4,736 cwts. from 3,810 cwts. in the preceding year.

An investigation was carried out during the year on coconut diseases at the Coast and an account of this will be found in the report of the Botanical Section (Appendix II).

Wattle Bark.

An extension of the wattle industry is revealed in the export figures of bark, though the quantity of extract declined considerably, as in shown by the following statistics :—

EXPORTS

1931		1930		1929		1928		1927	
Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Cwts.	£	*Cwts.*	£	*Cwts.*	£	*Cwts.*	£	*Cwts.*	£
WATTLE BARK									
192,368	67,203	131,160	44,680	63,342	25,336	101,619	39,112	44,082	17,338
WATTLE EXTRACT									
6,073	6,028	16,729	18,400	27,777	28,310	20,284	22,478	21,229	19,188

Additional wattle bark marketing rules came into force during the year, designed to improve the quality of exports by prohibiting trading in bark spoiled by rain, mould, etc. At the end of the year fresh rules were introduced, and came into force on the 1st January, 1932, requiring all purchasers of bark to take out licences, revocable on conviction of an offence under the former rules.

As a result of the above measures and of the organized marketing of native produce referred to elsewhere in this report, considerable improvement in the quality of exported bark has been effected, though much still remains to be done. A system of official grading is not considered practicable in the trade, and reliance will have to be placed on the deterrent effect of legislative measures, and improved marketing methods, and better preparation for market. Wattle growing is spreading rapidly in the Kikuyu Native Reserve. It is particularly suitable for native conditions in that it possesses several advantages. It provides shelter for man and animals, fuel for domestic needs, can be grown on land not the most suited for cultivation, provides a " cash crop ", and tends to improve the soil.

Potatoes.

Exports of potatoes recovered slightly from the reverse of 1930, as shown by the following statistics covering the last six years :—

YEAR	Quantity Exported	Value
	Cwts.	£
1931..	49,723	13,258
1930..	45,018	11,138
1929..	82,755	27,050
1928..	57,296	16,990
1927..	43,105	10,036
1926..	44,019	10,999

Largely as the result of departmental propaganda and experiment in past years and its marketing investigations with recommendations thereon, considerable importations of seed by private growers are now taking place. The problem of annual seed supply for the warmer areas is being solved. The Department continues to do investigational work with varieties for yield and keeping qualities and this work is being extended in 1932. A bulletin on " The Potato " dealing with the cultural side, was published in advance of the planting season. A good deal of export marketing information with advice was also published, dealing with several oversea markets.

Beginning with trials at the Scott Agricultural Lobaratories and followed by multiplication at Native Council seed farms and elsewhere, issues of seed potatoes of improved varieties are now being made in quantity. It is intended that these varieties should displace those now grown in the native reserves, sorts which are susceptible to various diseases.

The Agricultural Economist and the Agricultural Officer (Mr. Bailey) have been responsible for bringing improved packing into use after an intensive inquiry into different kinds of packing cases.

The report of the Chief Grader and Inspector shows that the quality of potatoes exported began to improve towards the end of the year.

The importance of exporting only potatoes whose grade and quality can be relied upon, and whose delivery at overseas ports in sound condition can be assured, cannot be too strongly emphasized. To that end the Grading Regulations were again brought under review.

Miscellaneous Crops.

A useful beginning has been made in the production of essential oils for export, and the exports during the year 1931 reached a total value of £8,091, as compared with £3,370 in the preceding year; a notable feature of the returns is the appearance of the United States of America as a customer for the main portion of the supplies exported.

A large range of crops is referred to in the census returns under the heading of "Miscellaneous Crops." It covers cassava, sunflower, chillies, ginger, groundnuts, linseed, millet, rice, sunflower, tobacco and other crops, some of which are of experimental value and may lead to important developments in the future.

ANIMAL INDUSTRY.

This Division embraces the administration of the Diseases of Animals Ordinance, "Field" Veterinary Services, Veterinary Research and Animal Husbandry. As in the case of Plant Industry and for similar reasons, reference should be made to the report of the Deputy Director (Animal Industry).

Apart from purely veterinary services, dealing with disease—investigational and control—which continue to be greatly appreciated, the services of the Department, related to stock breeding interests, have been much in demand, and useful necessary work has been accomplished. There remains much scope for the advancement of industry through better management, improvement through selection and breeding practice, combined with a greater knowledge of the production of animal products. Satisfactory progress has been made in marketing organization.

As a matter of primary interest and for record purposes a list of the *research and investigational* work which is being conducted by this Division is appended :—

Veterinary Research Laboratory.

East Coast Fever: Pathology; immunity in "T" branded cattle, susceptibility of game, buffalo, eland.

Bovine pleuro-pneumonia : Serum diagnosis.

Horse Sickness: Immunization.

East African Swine fever : Immunization.

Foot and Mouth disease : Typing of strains, investigation of methods of immunization.

Rinderpest : Further studies on the virus, particularly with reference to its mature.

Sterility in cattle : Pathological investigations.

Nairobi Sheep Disease : Transmission by ticks other than *Rhipicephalus appendiculatus.*

Rift valley fever : Transmission by different species of mosquitoes : Immunity.

Fowl parasites : Transmission.

Helminth parasites of cattle, sheep and poultry : Survey of species. Relation to parasites of wild ruminants and birds. Anthelmintic treatment.

Paratyphoid of calves : Improvement in antiserum.

Fowl Typhoid : Immunity.

Plant Poisoning : Survey of indigenous species, testing of toxicity.

Respiratory diseases the pyogenic infections of sheep and goats : Comparative etiological studies of the various lung conditions.

Contagious abortion of cattle : Observations on the efficacy of the rapid agglutination method of diagnosis as compared with the slow test.

Roup in poultry : Etiological studies in outbreaks not attributable to the virus of fowl pox.

Spirochætosis of pigs : Treatment.

Field investigations into the distribution of tick species and the incidence of tick-borne diseases in the Rift Valley and some adjacent districts.

Life-cycles of several species of ticks in Kenya.

The life-cycle of the sheep scab parasite in Kenya.

Distribution and extent of the tsetse fly belts and their relation to outbreaks of animal trypanosomiasis.

Experiments with Harris tsetse fly traps.

Study of blow-flies and myiasis.

Naivasha Farm, in collaboration with Rowett Institute.

The effect on milk production feeding maize silage.

The effect of a mixture of simsim cake and bran as a balance ration for milk production.

Extension of the period of the hand-rearing of calves.

Feeding experiments on pastures having an iron deficiency.

Growth rates of steers and heifers correlated with the monthly rainfall and condiiton of the pasture.

The effect of feeding a salt and bone meal mixture to newly weaned lambs.

Improvement of native sheep by crossing with—

(i) imported Suffolk rams;

(i) black-headed Persian rams.

The substitution of meat meal and groundnut cake in lieu of separated milk for bacon production.

The effect of the application of mineral fertilizers on the natural grazing.

Analysis of individual grasses on Government Farm.

African Animal Husbandry Training Centres.

Experiments in selective breeding of native cattle for milk production.

Investigation of types of native cattle in connexion with characteristics other than that of milk yield.

Trials of the effect on milk yield of supplementary feeding of native cattle.

Trials on duration of lactative period and of milk yield by removal of calf from the mother at birth.

Trials of methods of hand rearing of native calves.

Experiments on the rate of growth of native calves by feeding with bone meal and other minerals.

Grassland improvement experiments.

Publications.

Bulletins, Press articles, etc., emanating from this Division were as follows:—

Observations on Ticks and Tick-borne Diseases; by E. A. Lewis, M.Sc., Ph.D., Veterinary Entomologist (Bulletin No. 2/1931).

Methods of Segregation for Control and Eradication of Bovine Contagious Abortion; by W. B. C. Danks, B.Sc., M.R.C.V.S., Veterinary Research Officer (Bulletin No. 11/1931).

Ticks and Tick Eradication (Bulletin No. 13/1931).

Diseases and Ailments of Swine; by J. Walker, M.R.C.V.S., Chief Veterinary Research Officer (Bulletin No. 15/1931).

Diseases Affecting Poultry in Kenya Colony; by J. R. Hudson, B.Sc., M.R.C.V.S., Veterinary Research Officer (Bulletin No. 16/1931).

A Study of the Ticks in Kenya Colony. The influences of Natural Conditions and other Factors on their Distribution and the Incidence of Tick-borne Diseases. Part 1. : A Report on an Investigation into the Tick Problem in the Rift Valley; by E. A. Lewis, M.Sc., Ph. D., Veterinary Entomologist (Bulletin No .17/1931).

Horse Sickness; by J. Walker, M.R.C.V.S., Chief Veterinary Research Officer (Bulletin No. 20/1931).

Market Requirements for Pigs.

Commentary on the Occurrence of Arsenic Dipping Fluids of dangerously incorrect strengths.

Enzootic Hepatitis or Rift Valley Fever; by R. Daubney, M.Sc. (Wash.), M.R.C.V.S., Assistant Chief Veterinary Research Officer, and J. R. Hudson, B.Sc., M.R.C.V.S., Veterinary Research Officer (Journal of Pathology, Vol. 34 p.p. 545-579).

Nairobi Sheep Disease; by R. Daubney, M.Sc., M.R.C.V.S., Assistant Chief Veterinary Research Officer, and J. R. Hudson, B.Sc., M.R.C.V.S., Veterinary Research Officer (Parasitology. Vol. 23 pp. 507-524).

Supplementary Feeding of Dairy Stock; by W. D. D. Jardine, B.Sc. (Edin.), N.D.A., N.D.D.(Hons.), Live Stock Officer (Bulletin No. 8/1931).

Calf Rearing; by W. D. D. Jardine, B.Sc. (Edin.), N.D.A., N.D.D.(Hons.), Live Stock Officer (Bulletin No. 18/1931).

LIVE STOCK.

Native live stock are dealt with in the report of the Deputy Director (Animal Industry) and therefore the position is not repeated here.

Cattle.

The following table shows the numbers of live stock owned by Europeans during the last five years :—

	*1928	*1929	*1930	†1931	†1932
Cattle—Total	216,961	218,390	226,861	236,895	248,279
(*a*) Breeding Stock ..	110,796	115,777	129,311	135,530	147,095
(*b*) Other Cattle .	106,165	102,613	97,550	101,365	101,184
Horses	2,172	2,288	2,265	2,263	2,196
Mules	709	632	548	492	442
Donkeys	1,238	1,235	1,225	951	974
Sheep (wool-bearing) ..	176,261	210,912	207,237	218,845	202,456
Sheep (native)	20,608	24,586	23,708	27,507	32,751
Goats	3,211	3,926	2,840	2,972	2,312
Pigs					
(*a*) Breeding sows ..	3,455	3,108	2,738	2,691	2,449
(*b*) All others	14,697	14,638	14,632	12,539	11,261
Poultry	38,845	35,786	44,844	49,183	62,629

* As at 31st July.
† As at 28th February.

The total number of cattle in the possession of Europeans as at 29th February, 1932, was 248,279, an increase of 11,384 or 4.8 per cent over the figure for the previous year. The increase extended to all classes of breeding cattle; working oxen, on the other hand, again showed a slight decrease : from 69,793 to 68,025 in the present year; not so great as might have been expected, having regard to the reduction in the area of land under cultivation, but the change back from mechanical power to draught oxen has influenced the position materially.

Wool-bearing sheep decreased by 7.5 per cent during the year and the number is now returned at 202,456. Native sheep on European farms, however, increased by 19.1 per cent to 32,751.

The number of pigs further decreased to 13,760, a drop of 1,470 from the previous year's figures.

Slight increases in the number of horses and mules were recorded, while the number of donkeys also increased.

The poultry industry has continued to expand. An increase of 27.2 per cent in the number of birds in the year under review followed one of 9.7 per cent in 1930-31 and 25.3 per cent in 1929-30. The total number now stands at 62,629.

The total number of pure-bred stock showed a decline on the year, but this decline was not of any real significance, since it was entirely accounted for by a decrease in the number of bull calves. Pure-bred cows and heifers over one year, and pure-bred bulls, showed a combined increase of 23 per cent.

The total deaths of live stock from all causes were as follows: cattle, 18,870; horses, 242; sheep, 33,796; pigs, 1,244. Of the deaths in cattle, East Coast Fever is said to account for 14.3 per cent, Rinderpest for 3.6 per cent, and other causes 82.1 per cent.

Slaughterings of cattle at 10,119 show a decrease of 21 per cent from the figures of the previous year. Sheep, at 17,365, showed similar percentage decrease. Pigs, on the other hand, increased by 18 per cent to 9,977.

ANIMAL PRODUCTS.

The following is a comparative table of the animal products sold by Europeans during the last five years:—

	Milk (Whole)	Cream	Butter fat.	Butter	Cheese	Ghee	Wool
	gal.	*gal.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*
1931–32	1,018,868	77,063	675,910	285,320	111,582	96,471	813,662
1930–31	1,101,704	145,796	614,790	312,694	131,168	114,527	654,846
*1929–30	1,027,375	287,657	(*a*)	371,675	108,875	116,117	893,258
*1928–29	791,452	212,914	(*a*)	290,905	145,609	5,215	939,619
*1927–28	421,779	75,764	(*a*)	324,593	130,538	78,528	420,575

* In respect of the period 1st August to 31st July.

(*a*) Included in cream.

While the amount of butterfat shows an increase over the preceding year, the production of milk, cream, butter, cheese and ghee has declined. Dairy products as a whole show a decrease, in spite of the increase in numbers of dairy cattle which has occurred. This may be ascribed in large part to the widespread destruction of grazing by locusts which occurred, particularly during that period of the year when milk production should be at its maximum.

The production of wool amounted to 813,662 lb., an increase of 24.2 per cent over the previous year.

Statistics of dairy commodities produced by local creameries during the year were called for and the following are the quantities returned as received or manufactured :—

YEAR	Total quantity of milk received from Farmers	Quantity of butterfat received from Farmers	Products manufactured therefrom		
			Butter	Cheese	Ghee
	Gallons	*Lb.*	*Lb.*	*Lb.*	*Lb.*
1931–32..	167,043	864,516	1,069,043	69,728	19,416
1930–31..	118,688	1,083,877	1,207,295	79,247	55,958

Naivasha Farm. (Work conducted in collaboration with the Rowett Research Institute.)

Investigational and experimental work connected with animal husbandry was continued at this institution, and useful contributions were made to the knowledge of this branch of farming in the Colony. The more important investigations undertaken may be summarized as follows :—

Cattle.

Feeding Trials in Connexion with Milk Production.

Milk yield maintenance trial, feeding ensilage during dry season when grazing is scarce.

Trial of ration of simsim cake and bran feed in July onward to ascertain effect on milk yield during succeeding dry period.

Feeding Trials with Pasture.

Examination of dietetic deficiencies of pastures using bullocks, cows and calves in various stages of malnutrition, and their correction by feeding graduated mineral mixtures, including iron oxide and salt.

Liveweight increase trials with animals of various ages to ascertain the rate of growth of each with new luscious grass and more mature herbage. These trials should provide information for devising economical methods of management.

Milk, Yields and Costs.

Investigation of lactation periods, milk yields and fat content of milk of individual cows.

Costing investigation to ascertain the cost of production of milk, excluding overhead charges such as costs of management, rent, interest on capital, etc.

Hand-rearing of Calves.

Investigation of the causes of delay in growth of calves subsequent to weaning at six months of age, and methods of feeding to adopt to promote normal development.

Sheep.

Feeding Tests.

Trial of feeding wethers and ewes using salt and bonemeal mixture to note effect during seasons when grazing was adequate or scarce.

Progeny Tests.

Observations on weight at birth, rate of growth and susceptibility to disease of progeny of Suffolk cross Masai, Persian cross Masai, Masai and pure-bred Persian lambs.

Pigs.

Feeding Tests.

Investigation on the suitability of the carcass for bacon when separated milk in the ration is replaced by meat meal and groundnut cake.

Pasture.

Investigation of the chemical composition of herbage prior and subsequent to the application of fertilizers in the form of nitrate of soda, sodium carbonate, superphosphate and lime.

Finance.

Stock on hand at the commencement of the year was valued at Sh. 57,170/70, and at 31st December an increase in value of Sh. 13,923/30 was shown.

At the beginning of the year there was a balance of Sh. 12,748/59 standing to the credit of the current and deposit accounts of the farm. At the end of the year the balance had increased by Sh. 5,251/33 to Sh. 17,999/92. It should be noted that the farm expenditure does not include salaries of the two research workers, and no charge is made for rent or interest on capital.

INDIAN AGRICULTURE.

It has been made possible to give the following figures relating to the activities of the Indian farming community in the Kibos–Miwani area :—

	1931	1930
Total number of occupiers	46	56
Area occupied (acres)	14,614	15,400
Area under sugar cane (acres)..	4,470	9,120
Area under maize (acres)	..	700
Area cultivated, but not planted (acres).. ..	3,862	2,980
Number of working oxen	1,444	2,245
Number of other cattle	490	725

These Indian farmers have made considerable endeavours to develop the land under their occupation, but have suffered a severe setback through the destruction of their sugar cane and maize crops by locusts and the reduction in returns from sugar cane due to its lower sucrose content, again owing to damage by locusts.

In the Coastal area Indian occupiers of land produce coco-nuts, copra and fruit chiefly, but the output is comparatively small, and chiefly in the neighbourhood of Nairobi a number of Indian market gardeners pursue a considerable business in the growing and marketing of vegetable crops.

NATIVE AGRICULTURE.

The progress of native agriculture is well stated in the reports of the Deputy Directors of the Divisions of Plant and Animal Industries accompanying this report. These reports also deal fully with the departmental services rendered for the benefit of native agriculture. It is therefore not necessary to repeat the record here. Local Native Councils are taking a live interest in agricultural services and agricultural officers are gaining their confidence to a satisfactory degree. Grants from Local Native Councils in support of these services are increasing in amount. For 1931 the money voted from these sources for agricultural services amounted to £5,265. The position in regard to agricultural exports of native origin is shown in the following table :—

Native Agricultural Exports.

The estimated values of agricultural exports of native origin for the last five years are shown hereunder.

	1927	1928	1929	1930	1931
	£	£	£	£	£
Animals	12,000	11,000	10,300	8,600	5,000
Copra and coconuts	12,000	23,000	2,500	2,250	1,200
Cotton	15,000	24,000	24,800	17,200	6,500
Cotton seed ..	..	..	5,400	5,000	..
Groundnuts ..	22,500	19,659	29,500	16,500	6,000
Maize	75,000	50,000	45,000	75,000	..
Millets	3,350	423	240	2,800	20
Pulse	19,900	13,000	12,500	14,000	6,000
Simsim	67,350	27,355	27,500	15,200	5,000
Hides	160,000	200,000	220,000	105,000	60,000
Skins	56,000	100,000	87,000	73,000	35,000
Oils-various ..	3,550	5,000	10,000	6,700	3,200
Potatoes	7,500	7,000	24,000	10,500	13,000
Miscellaneous ..	2,600	2,000	2,000	2,000	2,000
Wattle bark and extract	..	..	35,000	42,000	71,000
TOTALS .. £	497,780	482,437	535,740	395,750	213,920

Three factors which affected the quantities of agricultural produce exported were: low prices on oversea markets; destruction of crops by locusts and increased domestic consumption.

During periods of low prices it is customary for natives to reduce production of cash crops, or when these are edible, as, for instance, groundnuts and simsim, to consume instead of selling them. Losses caused by locusts reduced the available surplus of maize from native reserves, and fear of food shortage caused natives to conserve supplies. The outward movement of maize and other native foodstuffs was prohibited by proclamation between the 28th May and 10th July, from the following areas: Machakos, Kitui, Meru, Embu, Fort Hall, Kiambu, South Nyeri and Baringo districts and Kisumu township. Coffee and sisal growing areas, chiefly in the Kikuyu Province, and some townships, depend upon native supplies of maize throughout the year.

For shipment oversea, produce must be standard in quality and offered in bulk, and as supplies from settled areas satisfy these requirements, exporters handle them with greater confidence than native produce. In these circumstances the considerable local demand for maize meal is met to a large extent from native grown maize. As an example, it may be mentioned that the requirements of the Kiambu district alone were some 600 tons of native maize per month. The net result was that no native grown maize was exported in 1931.

Crop returns and Agricultural Census figures, obtained by the Statistical section of the Department, provide reliable information of diminution or increase in output from settled areas, but unfortunately it is not possible to obtain particulars of this nature in regard to native production. Such means are not available for assessing native production and it would be erroneous to base an opinion upon progress in native production solely upon the estimates of exports. There is no doubt that the increase in acreage under cultivation by natives during the past few years has been very considerable, and it can be stated with confidence that production has increased accordingly.

GRADING AND INSPECTION (IMPORTS AND EXPORTS), ALSO GRAIN CONDITIONING AND COOL STORES SERVICES.

Financial.

The balance sheets for the year under review show a satisfactory financial year's working, the excess of revenue over expenditure for the combined Grading and Conditioning Services being £2,152/14/6.

At 31st December, 1930, the statement of balances for these services since their inception revealed a debit balance of £1,837 5s., and at 31st December, 1931 the credit balance was £315/9/6. The former balance takes into account the sum of £15,071, which amount represented a refund of four-fifths of the charges on the 1929-30 crops of maize and wheat granted as a relief measure by Government.

The year's working on the Government Cool Stores was not so satisfactory and the balance sheet showed a loss on the year's working of £1,186.

Plant Import Inspection.—18,742 packages of plants, seeds, fruit and bulbs, having a declared value of £17,032 were passed into the Colony, and 142 packages, valued at £247, were passed in transit to Uganda. Whilst there has been a steady fall in value of this class of imports during the last two years, the number of packages entering the Colony increases each year.

Grading and Conditioning Services.—Slight amendments to the Grading of Maize and Wheat Rules were gazetted to bring under control the artificial drying of grain by individual growers.

The Grading of Beans Rules, 1930, were promulgated, with effect from the 1st January, 1931.

The Inland Grading Service, inaugurated in 1930, was discontinued completely at the beginning of the period under review. Experience has shown that the value of the service was disappointing to those who advocated it and that the needs of the industry are met and the greatest efficiency maintained by locating the service at the port.

Maize.—During the year 1,124,464 bags of maize were graded. This represented a decrease of 33.93 per cent on the corresponding total for 1930. Particulars in respect of this service, including the number of bags of each grade and the number of bags of wet maize received from the various districts will be found in the report of the Chief Grader and Inspector (*see* Appendix VII).

Harvesting operations having been carried out under favourable climatic conditions, the bulk of the maize railed to the coast arrived with a satisfactory low moisture content. Only 5.32 per cent was rejected as wet, compared with 28.6 per cent in 1930 and 9 per cent in 1929. Maize submitted for grading throughout the season, including some received at the commencement, showed signs of infestation by weevils.

Three hundred and sixteen export certificates were issued for 1,000,215 bags of maize, and 34,070 bags of maize were shipped to local ports without certificates.

Wheat.—34,528 bags of wheat were received direct for grading, being a decrease of 70.85 per cent on the previous year's total of 118,632 bags. 17,482 bags, or 50.65 per cent of the wheat received was rejected as wet, whereas in the previous year 81. 68 per cent was rejected for this cause.

Sixty-one export certificates for 33,549 bags of wheat were issued, and, in addition, 993 bags were exported to local ports.

Grading of Potatoes.—42,764 cwt. of potatoes were presented for grading, showing an increase of 10.81 per cent on the total graded in 1930.

Grading of Beans.—Only 236 bags of beans were presented for grading.

Cool Stores.—For the first time since the opening of the Cool Stores there has been a decrease in the quantities of commodities deposited. Butter shows the most serious decline, being a percentage decrease of 45.77 per cent on the previous year's figures.

AGRICULTURAL SHOWS.

The Royal Agricultural and Horticultural Society of Kenya held two shows, one at Nairobi and the other at Eldoret. At both a comprehensive display staged by the Department, primarily educational in character, attracted much attention and received great commendation. The Society is experiencing considerable difficulty in covering its expenditure from income on account of the financial stringency and the reduction of the Government grant-in-aid from £500 to £250.

At the Nairobi show one of the most attractive features was the display of native-grown produce, both in sections for provincial and individual produce exhibits. One native agricultural show was held at Mumias, North Kavirondo, and it is hoped to resuscitate these valuable aids to agricultural progress in native reserves when conditions improve.

EAST AFRICAN STUD BOOK.

Progress is being made in securing greater efficiency in this service, which falls under the Royal Agricultural and Horticultural Society of Kenya, though this Department is closely associated with the work. Due to the efforts of the Secretary (Mr. Mervyn Hill) the horse section has been completely revised, and brought into line with the "General Stud Book." A new volume (No. 5) was published, and after all expenses were met there still stood to the credit of the Stud Book account a sum of Sh. 847.

LABOUR.

The average number of men, women and children (almost entirely Africans) employed on holdings in the European areas for the last five years are shown in the following table :—

Year	Men	Women	Children	Casual daily labour	Total
1931 ..	76,604	3,260	15,330	5,926	104,120
1930 ..	89,856	3,387	19,393	7,574	120,210
1929 ..	90,633	3,971	18,124	13,157	125,885
1928 ..	85,082	4,249	15,304	6,062	110,697
1927 ..	83,000	4,654	17,295	9,371	114,320
1926 ..	76,838	4,802	15,428	5,006	102,074

The greatest proportional decreases were in Machakos, Fort Hall and Uasin Gishu, while in Kiambu, North Nyeri and Trans Nzoia only slight decreases occurred. In general, the main decreases occurred in the sisal-growing districts, where the collapse of the market for sisal disorganized many estates, and where the lack of security for the future discouraged new planting and all but the most necessary cultural operations. A number of estates were completely closed down for varying periods during the year. In the Uasin Gishu low prices discouraged planting of cereal crops and locust damage further reduced the need for harvest labour. In districts with a fair proportion of coffee, employment has been better maintained, though the relatively small crop picked during the year diminished the need for labour for picking, with the result that the greatest proportional reduction was in the casual labour employed. In some degree the reduction in labour employed represents real economy in its use, the effect of which may become apparent when world conditions improve to such an extent as to provide a remunerative outlet for increased quantities of produce for export.

Board of Agriculture and Consulting Committees, Etc.

The Board continued to be engaged chiefly on the economic position of industries affected by the collapse in prices of primary products, and the chairman was occupied largely in preparing memoranda thereon, also on the subject of "Agricultural Credit." The operations of the Board were suspended when the chairman proceeded to England on a special mission in May and proposals for the resuscitation of the Board had not been given effect to by the end of the year.

Meetings of the various consulting committees for different industries were held during the year, and again it is desired to bear testimony to the cordial spirit of co-operation which exists between them and the Department, and the assistance which they have afforded. With other organized bodies, e.g., the Coffee Planters' Union, the East African Sisal Growers' Association, the Kenya Poultry Club, and Chambers of Commerce, close collaboration and mutual helpfulness has been maintained.

On the Central Agricultural Advances Board, the Department is represented by the Director, and on the Butter Levy Board by the Director and the Live Stock Officer.

AGRICULTURAL CREDIT.

The Land and Agricultural Bank of Kenya was instituted by the passing of the Land and Agricultural Bank Ordinance, 1930 (No. 3 of 1931).

The capital placed by the Government at the disposal of the bank was £240,000 and it was decided that the rate of interest to be charged borrowers should be 6½ per cent per annum. It is interesting to note that the instalment for a thirty year loan, combining interest and redemption is equivalent to 7.62 per cent per annum of the amount borrowed.

Not until the end of June, 1931, was the Board appointed and applications invited, and by the end of the year of the 256 applications received, 193 had been considered by the Board, who approved 90 and rejected 103. The remaining 63 applications awaited consideration by the Board. An analysis of the loans actually issued at 31st December, 1931, disclosed the fact that 45 per cent of the loan moneys went to meet existing mortgages, the balance being distributed over buildings, boreholes, fencing, dip-tanks, clearing new land, maintenance of existing crops (mainly coffee), and the purchase of land, stock, implements and machinery. Private money has been released for fresh enterprises, merchants in various centres have reaped their share of increased business, and a number of farmers have been able to place their affairs on a business basis free from the ever-present anxiety which attends a private mortgage, which may have to be redeemed at short notice.

In June, 1930, an amount of £100,000 was allocated by Government for the operation of the Agricultural Advances Ordinance, and, with the sanction of Government, additional funds from moneys repaid were made available with the result that £119,160 was advanced for the assistance of farmers from the date of the inception of the scheme to the end of 1931. Of this sum £26,462 had been repaid by 31st December, 1931.

At the beginning of 1930, advances had been granted to 103 applicants and by the end of 1931 the number of grantees in receipt of assistance from the Central Advances Board was reduced to 55.

The type of farms in receipt of advances at the end of 1931 may be classified as follows: coffee, 15; maize, 8; maize/coffee, 25; maize/wheat, 4; mixed, 3.

In examining the individual cases at the beginning of 1932, the Central Board were impressed by the remarkable reductions made in running expenditure and costs of production, and were of the opinion that, on the whole, participants had loyally co-operated with the Local and Central Boards in efforts to re-habilitate themselves and justify the assistance given to them.

Notwithstanding the very serious drawbacks to recovery caused by the further collapse of markets and the ravages of locusts, a scrutiny of the position of individuals shows a more satisfactory position than might have been expected in such adverse circumstances, and there can be no doubt but that the result of the application of the Ordinance has been to keep many worthy men on the land.

AGRICULTURAL LEGISLATION.

The following Ordinances and Rules affecting the agricultural industry were promulgated during the year :—

Ordinances.

Land and Agricultural Bank Ordinance, 1930.

Maize Subsidy Repayment Ordinance, 1931.

Butter Levy Ordinance, 1931.

Co-operative Societies (Registration) Ordinance, 1931.

Sale of Wheat (Amendment) Ordinance, 1931.

Rules.

Under the Branding of Stock Ordinance (Cap. 159 of the Revised Edition) :—

The Branding of Stock (Amendment) Rules, 1931.

Under the Butter Levy Ordinance, 1931 :—

The Butter Levy Regulations, 1931.

Under the Co-operative Societies (Registration) Ordinance, 1931 :—

The Co-operative Societies Rules, 1931.

Under the Crop Production and Live Stock Ordinance, 1926 :—

The Wattle Production Rules, 1931.

The Hides and Skins Rules, 1931.

Under the Diseases of Animals Ordinance (Cap. 157 of the Revised Edition) :—

The Diseases of Animals Rules, 1931, and Amendment Rules, 1931.

Directions and Conditions for Movement of Cattle, etc., to or from Native Areas.

The Diseases of Animals (Importation) Rules, 1931.

The Diseases of Animals (Scale of Fees) (Amendment) Rules, 1931.

Under the Diseases of Plants Prevention Ordinance (Cap. 155 of the Revised Edition) :—

The Locust (Amendment) Rules, 1931.

The Diseases of Plants, Prevention (Coffee) (Amendment) Rules, 1931.

Under the Food and Drugs (Adulteration) Ordinance, 1930 :—

The Food and Drugs (Adulteration) (Milk, Cream and Butter) Regulations, 1931.

Under the Sale of Wheat Ordinance, 1930 :—

The Sale of Wheat (Agency) (Amendment) Rules, 1931.

LIBRARY AND PUBLICATIONS, ETC.

In addition to the publications given under the sections dealing with Plant and Animal Industries, the following were published :—

A Decade of Agricultural Progress in Kenya ; by the Hon. Alex. Holm, C.B.E., Director of Agriculture (Bulletin No. 9/1931).

Annual Report of the Department of Agriculture, 1930.

Agricultural Census, 12th Annual Report, 1931.

Crop Reports : January, February, and July–December, 1931.

During the year " Field Officers " were supplied, as far as funds permitted, with standard works of reference and with the more important agricultural periodicals. A classified catalogue of the books in the Head Office and out-station libraries has been prepared, and typed copies distributed.

Each year the list of general agricultural and scientific periodicals, acquired by payment and by exchange, increases. This periodical literature is of great importance for purposes of reference and care is taken in maintaining complete sets. The binding of volumes is kept up-to-date as far as the resources of the Government Press allow.

The practice of the Department in distributing its publications to institutions and societies abroad materially benefits the library by receipt, free of charge, of reciprocal issues.

There are now 1,710 volumes in the library of which 150 were added during the year. These additions consist chiefly of bound volumes of periodicals. On account of the restriction of funds a smaller number of technical and scientific works were purchased. Attention is again called to the facilities afforded to " subscribers " of the free use of the books of the library, merely on a deposit being made.

In addition to his library duties the Clerk-Librarian is in charge of the distribution and preparation for press of all departmental publications.

Efforts continue to be made to secure the publication of an East African Agricultural Journal. The present method of issuing bulletins and Press articles only does not entirely meet the need, and is unsatisfactory in some important respects. The value of an Agricultural Journal cannot be overestimated, and the stage has been reached when it can be furnished by the staff of this Department with ample contributions, appropriate in character and quality.

INTER-DEPARTMENTAL SERVICES.

Close association has been maintained with the Native Affairs Department by means of consultations, discussions at conferences of Provincial Commissioners, and joint work in the districts by the Administrative and Agricultural Officers; with the Education Department for the organization of agricultural education, establishment and inspection of school gardens and association of seed farms with the larger native schools; with the Medical Department for propaganda in homestead sanitation, and projects for agricultural development in the sleeping sickness areas. The Government policy of co-ordination of Departmental activities in the reserves affects this Department in a large measure and Provincial Commissioners, who are co-ordinating authorities in their provinces, are giving practical effect to this policy, as far as practicable. It is, however, not always possible for those comparatively large areas of land, essential for certain services of this Department, to be made available at centres suitable for the activities of other Departments.

ACKNOWLEDGMENTS, ETC.

This report presents a fitting opportunity to pay tribute to the memory of the late Lord Delamere. His valuable pioneer work in agriculture contributed in no small measure to the settlement of the Highlands, while his abiding interest in the welfare of the agricultural industry brought him in close contact with officers of this Department, in the work of which he took a keen interest.

Mr. H. Wolfe, M.Sc., acted in my stead during my absence on leave, and Mr. D. L. Blunt, M.A., undertook the duties of Deputy Director (Plant Industry), *vice* Mr. H. Wolfe, in addition to the onerous duties associated with the direction of the locust campaign. It is with pleasure that the efficient discharge of their duties and responsibilities during a difficult period is recorded.

In a Department dealing with such wide and complicated issues, as does this Department, " team work " between the scientific and technical officers in particular is essential and it is gratifying to be able to state that a spirit of cordial co-operation and helpfulness exists among the officers of the various Divisions and sections to a noteworthy degree.

It is desired also to acknowledge with appreciation the valuable assistance rendered by colleagues of other Departments, both at Headquarters and in various parts of the Colony.

ALEX. HOLM,
Director of Agriculture.

June, 1932.

NOTE.—Accompanying this report are Divisional and Sectional reports of the following :—

Appendix. No.

PLANT INDUSTRY—

Report of Deputy Director.
Report of Acting Senior Entomologist I
Reports of Senior Mycologist and the Agricultural Officer in charge Grassland Improvement and Plant Introduction II
Report of Acting Senior Agricultural Chemist III
Report of Agricultural Officer, Scott Agricultural Laboratories IV
Report of Senior Coffee Officer V
Report of Senior Plant Breeder VI
Report of Chief Grader and Inspector VII

ANIMAL INDUSTRY—

Report of Deputy Director, and Chief Veterinary Officer.
Report of Chief Veterinary Research Officer VIII
Report of Live Stock Officer (Animal Husbandry) .. IX
Report of Government Farm, Naivasha (in collaboration with Rowett Institute) X

STAFF—

CHANGES AND NEW APPOINTMENTS, 1931.
STAFF LIST AS AT 31ST DECEMBER, 1931 XI
SUMMARY OF METEOROLOGICAL RECORDS XII

ANNUAL REPORT OF THE DEPUTY DIRECTOR (PLANT INDUSTRY) FOR 1931.

ADMINISTRATION.

The normal work of the Division has been hampered during the year by the necessity of placing a number of its officers at the disposal of the locust campaign services, which were under the charge of the Acting Deputy Director of the Division. The necessity of effecting economies in the Department, accomplished mainly by the non-renewal of the service agreements of certain temporary officers, also contributed to the curtailment of normal services.

The Rift Valley Province was left without an Agricultural Officer for part of the year and the work was undertaken by the staff of the Plant Breeding Station at Njoro, chiefly by the Agricultural Officer at that station.

An Agricultural Officer was posted to the Trans Nzoia district for the first time, with headquarters at Kitale. He immediately undertook a large range of work, chiefly field experiments and maize breeding, which, together with his advisory services to farmers, have laid the foundation of a badly needed service for agricultural improvement in that important part of the Colony.

It has been possible to maintain the staff in the native areas with the exception of the Meru district, which has previously had its own Agricultural Officer and has now had to be placed under the Agricultural Officer for the adjoining district of Embu. This re-arrangement necessitated the taking over of South Nyeri district by the Agricultural Officer, Fort Hall.

The Director's absence on leave from February to October and the carrying out of his duties by the Deputy Director (Plant Industry), together with the devotion of the services of the Acting Deputy Director largely to the locust campaign, placed a great deal of pressure on the Head Office staff of the Plant Industry Division at a time when new development work in the native areas was being initiated. With this development work now well in hand the necessity for decentralization of authority for services in the native areas has become pressing. The system in certain other territories of appointing Senior Agricultural Officers for Circles or Divisions can be very well adapted to Kenya, as the Kikuyu, Kavirondo and Coastal Native Reserves form suitable Divisions in themselves, being large provinces of widely varying conditions. Particulary in Kikuyu and Kavirondo such de-centralization is urgently needed.

The vacant post of Soil Chemist was filled during the year by the appointment of Mr. G. H. Gethin Jones, though shortly after his arrival he was obliged to take over the duties of the Senior Agricultural Chemist until the end of the year, owing to the latter's absence on leave.

In the Entomological Section the Senior Entomologist was absent on leave for the latter half of the year and one Entomologist during the first half. The time of the Acting Senior Entomologist was largely taken up by laboratory work with locusts.

The work of the Botanical Section proceeded normally without any interruption of services.

The Plant Breeding Staff has been at normal strength throughout the year and has undertaken the supervision of a good deal of outside experimental work in the Rift Valley Province, normally carried out by the Agricultural Officer for that area.

The Senior Coffee Officer, being the only technical officer in his section, has been very hard pressed for advisory services. He has been unable to meet all the demands upon his time. He has a good deal of investigational work in hand, as well as the administration of the coffee regulations. This section cannot do justice to the industry until its staff of technical officers is increased and it is relieved of the administration of the regulations. The latter is now receiving consideration. The plantation inspection services suffered considerably during the year by the use of the Inspectors to assist in the locust campaign.

WORK FOR IMPROVEMENT OF CROP PRODUCTION.

The chief work for improvement of crop production during the year other than for native agriculture (which receives reference later) is shown in detail in the reports of the specialist and experimental services contained in the Appendices. From these have been excluded the reports on the whole of the field experimental work and crop production studies in the general farming areas of the Rift Valley and Nzoia Provinces. These have been published in bulletin form in 1932, to provide the information to farmers in advance of the planting season, and have been omitted from this Annual Report to avoid duplication. The bulletins comprise the work on the Plant Breeding and Experiment Station at Njoro as well as the experiments conducted by the Deparment in co-operation with selected farmers on their own land. Reference may be made by those interested to the following bulletins, which will be sent to oversea enquirers on request :—

Bulletin No. 3 of 1932.—Notes on some Cash Crops and Green Manure Crops at Njoro and in the Trans Nzoia, 1931.

Bulletin No. 4 of 1932.—Further studies on improvement of Maize Yields in Kenya Colony.

Bulletin No. 7 of 1932.—Field experimental Work and Crop Production Studies, 1931.

At the end of Bulletin No. 7 of 1932 will be found a complete list of varieties of crops tried in different parts of this region in 1931, with a note on the performance of each. These bulletins have been compiled by the staff of the Plant Breeding Station and the Agricultural Officer, Kitale, who were responsible for this work.

The services for improvement of the cereal industries are faced with the complex problems involved in the discovery of new physiological forms of rust on wheat, the spread of certain rusts beyond the limits of altitude to which they were believed to be confined and the increasing severity of root and ear diseases of wheat and maize with the increased humidity of the last few years. Concentrated attention is being given to these problems.

The experimental work apart from coffee has been directed chiefly to the introduction into the farming system of methods of improvement and maintenance of soil fertility, to crop-production studies with maize and wheat and to increasing the variety of cash crops for the cereal-growing and other areas.

The depressed condition of the maize and wheat industries has led growers of these crops to realize the stern necessity of maintaining soil fertility, and thus high yields, as a means of keeping the cost of production low, and of crop-diversification as a means of spreading risks and of widening the market for the farm production. The necessity for the change over to mixed farming (crops and live stock) is occupying the anxious attention of farmers in the cereal-growing areas and this Division has been in close touch with the committees of certain farmers' associations for discussion of difficulties and the means of removing these, and for assistance in devising model systems of mixed farming in the particular areas.

The coffee investigational work is dealt with by the Coffee Section in Appendix V. With a little further advance in this work it is hoped to publish a comprehensive bulletin. Attention is being given increasingly to organic manuring and to the production of pedigree strains of trees by vegetative propagation, for high yield and resistance to adverse climatic conditions. In respect of the latter one or two serious problems will have to be overcome before success is achieved and this is not looked for within the next three years. The result of spraying trees for prevention of leaf-fall and for stimulating fresh growth is particularly valuable and the practice has already been taken up extensively by growers with satisfactory results. A scheme for a co-operative investigation with the Amani Institute, for determination of the factors influencing the liquoring quality of coffee, is receiving attention. The assistance of the Imperial Institute and merchants in London for this work has been secured.

The report of the experimental work, other than for coffee, at the Scott Agricultural Laboratories, Nairobi, will be found in Appendix IV.

A substantial amount of experimental work is being done by the Division, with limited staff and with inadequate facilities for centralized experimentation. The trial of green manure and cover crops, badly needed in the plantations and general farming areas, is an important and large-scale feature of the work. Throughout, resort is made to co-operative experiments with farmers on their own land and the thanks of the Department are due to those participating in this way. A list of the experimental and investigational work in hand is given in the Director's report.

Entomological Services.

The locust campaign interfered considerably with the research work of two entomologists. Investigations into control measures and observations on the life history and habits of locusts were carried out so far as resources allowed.

An investigation of the value of paraffin extract of pyrethrum against Lygus and Antestia, two serious pests of coffee, engaged the attention of a research entomologist for practically the whole year. The results have been most satisfactory and when applied should lead to a substantial increase of the coffee crop. Technical papers describing the method in detail are shortly to be published.

Leaf-eating caterpillars in coffee have again been noticeable in certain districts. Investigations into their parasites have been commenced but difficulty is being experienced in the breeding of the adults in captivity.

The coffee mealy-bug (*Pseudococcus lilacinus*) still continues to be a serious pest in those areas in which it occurs. Its incidence in the Colony appears to be extending and its range of host plants increasing. The most effective enemies of the mealy-bug are polyphagous predators. In this respect it is worthy of note that several indigenous species of ladybirds are proving useful in the field. Considerable attention is being given to breeding these species in the insectaries. Nine tons of potatoes were used during the year and 100,000 adult ladybirds distributed to plantations. In order that the possibilities of biological control may be improved, endeavours are being made to introduce other predators which are specific parasites of this mealy-bug. The simplification and cheapening of the banding process and improvement of repellents at present in use is being investigated, as the most practical way of increasing the efficacy of ant control. The planter should direct his efforts and funds to the permanent maintenance of the bands in perfect condition.

During the year maize stalk-borer was much in evidence owing to there being no restricted period for planting maize in the previous season, a relaxation of the regulations due to the depressed condition of the maize industry.

The annual report of the Entomological Section will be found in Appendix I.

Botanical Services.

The work of this section has been concerned mainly with plant pathology, grassland investigations and plant introduction.

In collaboration with the Coffee and Chemistry Sections and under the immediate charge of a Plantation Inspector stationed in the district, a comprehensive programme of experimental work on the control of Coffee Berry Disease has been put in hand in Sotik. The experiments include cultural, nutritional and fungicidal treatments.

A fourth physiologic form of wheat stem-rust was discovered during the year and the presence of a new wheat disease, " Take-all ", was established. Work on root rots and other diseases of wheat and maize was continued, in association with the work of the Plant Breeding Station. A study of the cluster cup stage of a rust on indigenous barberry from the point of view of its possible relation to wheat stem-rust strongly supports the view that the two are not connected.

An investigation on gumming and nut-shedding of coconuts at the Coast showed these to be physiological disorders.

The annual campaign against Striga weed (parasitic on maize) in Nyanza Province proved successful within the limits imposed by the prior necessity of combating frequent and heavy locust invasion.

Free issues of sugar cane of varieties highly resistant to mosaic disease were made to growers in the previously infected areas of Nyanza Province.

Work on grassland improvement has been mainly devoted to the determination of the valuable indigenous herbage species. Considerable progress has been made in deciding the order of palatability of a large number of the principal grasses of the Colony and information has been obtained on their nutritive value by means of chemical analyses. The reaction to management of the indigenous grasses is being studied by means of experiments on plots of the pure species and on natural pastures. In connexion with the former, information is being collected on yields of both herbage and nutrients and on establishment from seed. The work, which is centred at the Scott Agricultural Laboratories, is being extended by means of observational experiments under varied soil and climatic conditions.

Well over two hundred species and varieties of economic plants were introduced and distributed for trial in various districts. Information from reports received has been tabulated for future guidance.

The annual report of the Botanical Section will be found in Appendix II.

Chemical Services.

The appointment of a Soil Chemist has substantially increased the value to the agricultural community of the important services of this section, as evidenced by over four hundred personal inquiries received during the year and 1,305 samples of materials received for examination.

It is gratifying to report that there has been an improvement in the accuracy of the strength of the dip samples received. Most of those dangerously incorrect were received during the rains, which demonstrates how valuable a dip tester would be to a stockowner.

Further analytical work has been done on indigenous feeding stuffs of unknown composition and feeding value. *Tritonia laxifolia* (Montbretia) and *Digitaria abyssinica* (Couch), the latter mainly in the form of underground stems as cleared from cultivated land, were shown to possess comparatively high feeding values.

Air-dried locusts have been found to have an average composition of approximately 55 per cent crude protein, 15 per cent ether extract and 15 per cent crude fibre. Locust meal was found to be palatable to stock. The manurial value of dried locusts is shown by the following average analyses: nitrogen, 9.7 per cent; phosphoric oxide, 1.2 per cent; potash, 0.5 per cent.

Further work on the production of suitable essential oils has been prosecuted. Kenya Colony is found to be rich in indigenous scented plants, but most of them unfortunately carry oils that are either very similar to other oils more easily produced, or are distinctly unpleasant. The most promising indigenous plants appear to be *Juniperus procera* (East African Cedar) and *Brachylæna hutchinsii* (Muhugu). Samples of oil obtained from the wood of both these trees have been favourably reported upon by the Imperial Institute. The most promising exotic plants appear to be geranium, lemon grass, peppermint and possibly lavender.

A good deal of the time of the division is occupied with investigational work with coffee, in association with other sections. The principal work of the kind has been the coffee berry disease investigation. It appears that there is no simple correlation between soil and the distribution of the disease. Although it is certain that climatic conditions form the dominating factor in the general incidence of this disease, it is believed that the susceptibility to attack must partly depend in some way upon micro-climatic conditions and the intake of nutrients from the soil.

Good kresotow, provided that the coffee trees are properly banded, remains the most effective ant-repellent for the control of coffee mealy-bug; but there has been much difficulty in obtaining uniform supplies of good kresotow, as laid down by specification. Search for alternative methods of banding is being conducted, and work upon cheap home-made banding greases has been commenced.

In soil research, a start has been made to study the fundamental nature of the clay fraction of the Kikuyu red loam, which represents most of the coffee acreage of the Colony. The clay fraction is found to have a silica-alumina ratio (molecular) of about 2.2, and thus the soil approaches a lateritic loam.

Lysimeter experiments showed that the losses of nitrate nitrogen in a fairly typical maize soil amounts to as much as thirty pounds of nitrogen per acre during the long rains of some twenty inches. This emphasizes the vital need of checking, as far as possible, the natural leaching of nitrates by the growing of green manures, and the early planting of maize, whenever this is possible.

Field experiments on the rate of the nitrification of ammonium sulphate and the leaching of nitrates in a typical coffee soil showed that there was rapid nitrification until all the ammoniacal nitrogen had been oxidised within about ten weeks of application and confirmed the usual advice to aim at the uniform broadcasting of sulphate of ammonia in small and repeated dressings.

Other items of soil investigational work carried out include the standardization of simple field testing outfits; pot culture work with coffee to ascertain, if possible, the characteristic symptoms brought about due to deficiencies of the various elements of nutrition; field experiments with a few trees to note the effect of unbalanced manuring of coffee.

The annual report of the Chemistry Section will be found in Appendix III.

Plant Breeding Services.

Wheat.—A new physiologic form of stem-rust was found at Ulu in 1931 and has been called K4. Fortunately Kenya Standard is moderately resistant to it and all the "Njoro" wheats are resistant.

The following summary is given of the position of wheat breeding in the Colony.

Encouraging progress is being made at the Scott Agricultural Laboratories. Work is concentrated on the production of wheats superior to Kenya Standard, that is, stronger growers, better yielders, much more resistant to leaf-rust and of higher bushel weight, whilst retaining the stem-rust resistance of Kenya Standard. It is thought that success is in sight and the new hybrids are now in the fourth filial generation. There are also other new wheats, superior to Kenya Standard and now being multiplied, which should soon take the place of that wheat; that is, sooner than varieties from the new hybrids.

Some of the new Njoro wheats have now been well tested out by farmers and found to be completely resistant to all forms of stem-rust and sufficiently resistant under normal conditions to yellow-rust. They also yield well and are in most agronomic respects very satisfactory. Unfortunately, those tested in bulk have been found unsatisfactory for bread making. The main faults are colour, which can to a certain extent be overcome, and lack of stability. Stability consists in an ability by the dough to stand up for a sufficient length of time and, whilst of no particular importance to individuals who make their own bread, it is of great importance to bakers who make a large number of loaves at a time.

At least two possibly suitable new varieties are available now, however, for the higher altitudes and for all districts with a prolonged rainy season, and there is a possible third. The first is known to be of satisfactory milling quality and is fairly resistant to yellow-rust. Its stem-rust resistance is doubtful but it has now been grown for four years at Molo without any sign of that rust. It is probably moderately resistant to one or more physiologic forms and it will be tested out in this respect next year.

The second variety is known to be resistant to all physiologic forms of stem-rust except K2, to which it is moderately susceptible, but to which it has not succumbed during the past four years. It is moderately resistant to yellow-rust and has shown no signs of it during that time. Its milling quality is still doubtful, but it is probably better in this respect than are the majority of the Njoro wheats.

The third variety is very resistant to stem-rust and yellow-rust and again looks to be of better milling quality than the ordinary types.

It is hoped that, if Equator continues to suffer damage from stem-rust, these three varieties will help to carry the industry on from 1933 onwards until really good varieties are produced, of which something will now be said.

Since from the appearance of the grain of the Njoro wheats doubts were entertained of their milling quality, small quantities were sent to England several years ago for report. This report differed from the local one in that it was satisfactory. The reason probably is that it has been found that the sample of grain as produced by farmers bears little resemblance to that produced at the Plant Breeding Station. Nevertheless, it is the farmer's sample that counts, and it must be partly the fault of the wheat that it should deteriorate so much under farming conditions, chiefly at the higher altitudes.

In view, however, of the doubts entertained at that time as to the milling quality of these wheats, further crosses were fortunately then made with a view to improving their milling quality whilst retaining their rust resistance. These efforts appear to have been successful. The miller has reported extremely favourably on the appearance of some fourth-generation grain. It will be a matter of five years before these wheats will be available in large quantities.

Maize.—It is gratifying to find that a number of farmers have carried out, during the past year, the improved methods of maize-growing advocated by the Plant Breeding section of the Department (which is also in charge of cereal investigations) and with most successful results in greatly improved yields per acre over any previously obtained. Spacing experiments and censuses of maize fields were continued in 1931 and confirmed the opinions formed as a result of the experiments of 1930. It was further found that hill-planting, whether the hills consisted of three plants or two plants, yielded as well as row-planting, and that for practical reasons the former was greatly to be preferred. Correlation of results between the spacing experiments and census showed that whilst 8,500 plants per acre was a sufficient stand for good yields (where this was very accurately done in spacing experiments), it was better to aim at something like 11,000 plants to the acre in practice.

The breeding of selfed lines in the Trans Nzoia and at the Plant Breeding Station, Njoro, is progressing satisfactorily. It is thought that resistance to White Blight has already been secured and every effort is being made to follow up this success by fixing resistance to Fusarium diseases also. This work is of particular importance in the Trans Nzoia, where diseases of maize play such a large rôle in reducing yields. In order to achieve, to some extent, a similar result farmers are being urged to undertake mass selection and to select for seed cobs free from disease and of a resistant type.

To further this object, the Maize Seed Competition, referred to last year, was organised by this Department in conjunction with the Royal Agricultural and Horticultural Society of Kenya. There were eleven intrants each for Njoro and Trans Nzoia sections, and the results, which were most interesting and instructive, were fully discussed by departmental officers at three highly successful Farmers' Days at Nakuru, Eldoret and Kitale early in 1932.

Selection work on Muratha maize was continued at the Scott Agricultural Laboratories and issues of improved seed have been made. Multiplication and issues will in future be organized through the Local Native Council Seed Farms An experiment at the Scott Agricultural Laboratories demonstrated that improved Muratha maize yields nearly 50 per cent higher than ordinary native maize, whilst remaining early-maturing enough for the Kikuyu Province. This is a satisfactory achievement and demonstrates the value of plant-breeding for native agriculture.

Scott Agricultural Laboratories.

These laboratories are the headquarters of the Entomological, Chemical and Botanical Sections of the Department. In addition, a good deal of field experimental and investigational work is carried out by the Agricultural Officer in charge, chiefly with coffee. It is, as well, a station for the Plant Breeding Services, for wheat and maize. The Native Agricultural Training School for the Kikuyu Province is situated in the grounds, under the charge of the Agricultural Officer, South Kikuyu.

All field and experimental work has been greatly hampered by the continual invasions of locusts. The field of selected Muratha maize was, however, saved and the Grade I seed from this plot yielded 15½ bags per acre.

The wheat crop suffered badly from both leaf-rust and black stem-rust.

The Kudzu Vine has attracted much attention. Twenty-seven issues of roots have been made to stockowners in different parts of the Colony.

The Pyrethrum plot has borne heavy flowerings and issues of small quantities of seed have been made.

Fifteen different varieties of essential oil plants were established on the farm during the year.

Thirty-seven indigenous legumes were received from different parts of the Colony and planted out for purposes of observation for economic value.

The Agricultural Officer's report on the coffee investigational work, carried out under the direction of the Senior Coffee Officer, will be found in the report of the Coffee Section, Appendix V.

The record of other experimental work will be found in the report of the Agricultural Officer in charge, Appendix IV.

Njoro Plant Breeding and Experiment Station.

This station is chiefly devoted to the improvement of the cereal industries. Notes on its breeding work during the year have already been given under the heading " Plant Breeding Services." Another feature of its work is the extension services which it performs, not only advisory services by a staff of considerable practical experience, but the extension of its experimental work in co-operation with farmers in various parts of the Rift Valley Province. In his report (Appendix VI) the Senior Plant Breeder draws out very clearly the seriousness of the problems confronting the wheat and maize industries and the promise which the work being done holds out of finding a solution to these.

The report on the experimental work of the station has been published in the bulletins to which reference has previously been made.

NATIVE AGRICULTURE.

Local Native Council Seed Farms.

One of the main features of the agricultural services in the native reserves in past years has been the numerous small demonstration plots. It was decided that these had served their purpose as such and efforts were made to substitute for them the system of Native Council Seed Farms. These have the following advantages :—

(*a*) They provide the only practical means at present of a direct and active share being taken by the native authorities in the responsibility for agricultural development of their own areas—" uplift " from within (rather from without)—thus also in themselves developing the sense of responsibility in the native leaders.

(*b*) They serve as demonstration centres for improved crops and methods (higher yielding varieties, better spacing and improved implements are the main directions for improvement in native crop production).

(*c*) They provide a definite enterprise and stimulus to engage the interest and ability of the Agricultural Officer.

(*d*) They maintain a permanent source of uncontaminated seeds of the kinds required (the purity of seeds is frequently lost through mixing with inferior varieties).

(*e*) They furnish the means for centralized multiplication of such seeds. In addition, propagation of fruit and timber trees and the raising of poultry, for distribution in the reserves, are to be carried out on them.

In the organization of agricultural services and development, these seed farms provide a necessary link between the regional experiment station (from which proved varieties and methods issue) and the individual native. Without them, the field work becomes mainly propaganda and experience has shown the futility of propaganda as the sole or the chief means of accelerating native development.

This policy, so far as Kenya is concerned, is still in its infancy : difficulties in initial stages in obtaining adequate land in certain areas to make experiments really worth while indicate that recourse to other sources of seed supply may have to be considered as an alternative policy.

The following is a list of the seed farms in operation in 1931 or budgetted for by the Councils for 1932 :—

PROVINCE	DISTRICT	LOCATION
COAST ..	Digo	Kwale.
,, ..	Malindi	Gotani.
KIKUYU ..	Embu	Embu.
,, ..	Embu	Chuka.
,, ..	Meru	Meru.
,, ..	Meru	Oringu.
,, ..	Kiambu	Fort Smith.
,, ..	Nyeri	Nyeri.
,, ..	Nyeri	Murigo's.
,, ..	Nyeri	Keruguya.
,, ..	Fort Hall	Fort Hall.
,, ..	Fort Hall	Wakoma's.
,, ..	Fort Hall	Githua's.
UKAMBA ..	Machakos	Machakos.
,, ..	Kitui	
NYANZA ..	Central Kavirondo	Maseno.
,, ..	North Kavirondo ..	Kakamega.
,, ..	South Kavirondo ..	Kisii.
NZOIA ..	Nandi	Kapsabet.

Organized Marketing of Produce.

Early in the year propaganda by Agricultural Officers amongst natives in the Kikuyu Reserve to join in bulk marketing of produce revealed an immediate readiness to grasp any opportunity of escaping from the confines of the existing marketing system. Certain native dealers in produce had, in fact, already grouped themselves into trading syndicates and were awaiting a lead for the organization of bulk sales of the produce bought by them from the growers. Consultation with large dealers in Nairobi elicited support from these firms. District Commissioners gave their warm support. Native

Councils proceeded to vote funds for the erection of godowns. With the completion of these, the organization of deliveries and of sale followed, the latter through commission agents. At the same time, with the passing of the Co-operative Societies (Registration) Ordinance, the District Commissioners, Kiambu and Fort Hall, gave the organization in their districts a turn towards the formation of co-operative societies. It was feared that these were premature, but while in process of formation, a full season's organized marketing has taken place in the areas served by the godowns. With this initial success and the insistence of the natives on the co-operative system (because of the principle of compulsory sale through the Society of the produce of members), the movement for co-operation cannot be arrested and it is therefore supported, in the belief that the employment by the societies of capable and reliable agents, and by the Government of an Inspector of Co-operative Societies for the necessary constant watchfulness of accounts and methods of management which neither the administration nor the agricultural staff will have the time to exercise after the first year of operation, will provide assurance against failure when supported by such experienced guidance as the Agricultural Department is able to provide. In the knowledge that chief dependence against failure must be placed on capable and trustworthy management, it is believed that these safeguards will be adequate for the present and that the societies will shortly be in a position to engage suitable managers on their own account.

South Nyeri is the third district in the reserve in which organized marketing is beginning. In this area, through the influence of the District Commissioner and the Agricultural Officer, a longer period is to be given to the initial system of marketing in association without the formation of a co-operative society.

The godowns erected in 1931 or sanctioned for erection early in 1932 are given in the list below, together with the numbers of the adult male population in the areas which they serve. The number of these godowns shows an exceedingly satisfactory beginning of this movement for organized marketing. The movement is expected to spread rapidly, possibly too rapidly for the present European control. It is to be hoped the societies will appoint their own managers, and the Government an Inspector of Societies, with as little delay as possible.

LIST OF GODOWNS

District	Situation of Godowns	Supplementary Collecting Depots	Adult Male Population in Area Served
KIAMBU ..	Thika		
	Ruiru	.. .. ..	28,500
	Kabete ..		
	Limuru ..		
		"A" Route, Limuru	3,400
		Uplands	
		Kamiti	
FORT HALL ..	Fort Hall ..		
	Maragua ..	.. .. ..	40,000
	Mitubiri ..		
	Thika		
NYERI	Karatina ..		
	Kamakwa ..	.. .. ..	20,000
	Gakindu ..		
		Total ..	91,900

Tribute is to be paid to the zeal and hard work given to this introduction of organized marketing by the District Commissioners of the three areas, Kiambu, Fort Hall and South Nyeri, who soon realized that, as Administrative Officers, the bulk of the work (largely administrative)would have to fall on their shoulders if a successful start were to be made, and they have not spared themselves. The Agricultural Officers for South Kikuyu and Fort Hall have been worthy helpers in getting and keeping the movement under way in co-operation with the District Commissioners. It is a great pleasure to be able to afford to Agricultural Officers some definite enterprise such as this which brings out all their keenness and ability.

It is hoped to introduce marketing organization in the Kavirondo Reserve in the near future.

The Main Problem.

Much as may be done to improve and increase production by the means described above, they do nothing to solve the serious problem of depletion of soil fertility, which is facing a large part of the Kikuyu and Kavirondo Reserves. On the contrary, they aggravate it by increasing the produce surplus to family needs which is sold out of the reserves. Nothing is returned to the soil to make up for this annual drain of plant foods. In the Kikuyu Reserve particularly, the problem is causing this Department great anxiety. Over the greater part of the reserve, no cattle are kept on the agricultural holdings, but, instead, in communal grazing areas at lower altitudes at some distance from these holdings. The compost pit has been introduced, but it can be of little assistance without farmyard manure. The native will not give up his land to green manure crops and will not buy fertilizer. It is to be taken for granted that in his present circumstances he cannot afford to do either. Excessive land fragmentation complicates the problem.

Small Holdings the Remedy.—An experimental small-holding of four acres was established by the Agricultural Officer, South Kikuyu, in 1930–31 as part of the agricultural training and educational work with natives at the Scott Agricultural Laboratories, which is under his charge. In order to ascertain if a suitable living for a native family could be derived from it, in 1931 it has been worked entirely, though under the guidance of the Agricultural Officer, by a Native Agricultural Instructor who had taken the educational course mentioned. Its design is to provide food-crops, cash-crops and livestock pastures with the necessary buildings, animals and machinery. The operation of it was entirely successful showing a substantial profit for the year, after allowing for depreciation in value of buildings and machinery and appreciation in value of livestock. Complete details will be found in the Agricultural Officer's published report, which will be furnished on request. The success of this experiment has pointed the way to a practical solution of the serious problem described above; rotational arable and pastoral fields, with manure and compost applied to the crops, in small holdings, organized within the native system of land tenure. This solution of the soil fertility problem is much in accord with the policy governing native land tenure in the Kikuyu Reserve recommended by Mr. H. S. Fazan, District Commissioner, in an able report following his study of the subject in South Africa. The Department of Agriculture can do no more than assist by advice in the establishment of demonstration holdings in the reserves and in propaganda for land consolidation (to replace fragmentation) and for the adoption of the small-holding system. The rest must be left to the Native Affairs administration. The size of the holding will vary with the natural fertility of the soil and the numbers of the families in the area; the extent to which future generations and increasing size of families and dependents should be taken into account being a matter for the consideration of the Administration. An experimental small-holding is in course of establishment by the Department at its Bukura Station, in the Central Kavirondo Reserve, and the movement is spreading to the Ukamba Reserve.

It is desired to say that the significance of this should not fail to be appreciated by those in charge of the well-being of the natives. It cannot be impressed too strongly that maintenance of soil fertility is the essential basis of the contentment of these people and that depletion of fertility in areas where shifting cultivation is at or near its end, owing to scarcity of land, must lead to their complete impoverishment and possibly, as has happened to communities of European descent in other parts of the world, to land abandonment. The political implications of such a critical situation in native economy will be appreciated.

Experimental Stations and Native Agricultural Training.

It will take years to bring about over any large area the reform outlined above. In the meantime much assistance could be given towards the proper development of the small-holding mixed-farming system by experimentation accompanied by plant-breeding and selection in the reserves. The Department has long wanted a station in each of the two large reserves, to include an agricultural training school for selected natives. The two existing schools, one outside the (Kikuyu) reserve and one a make-shift establishment in the (Kavirondo) reserve pending its transfer to a more suitable locality, would be transferred to such stations. All the elements that go to build up a proper agricultural service for these reserves are now being provided except the fundamental one of the experiment station. It is felt that if the Native Councils were made to realize the importance of such a station and training school to their reserves, they would not fail to contribute substantially towards its cost. These regions, Kikuyu and Kavirondo, are valuable reserves of wealth to the country. Tanganyika, which has three experiment stations in native areas, has no region comparable to them in density of population and productivity together. Experiment stations for them, as well as for the Coast Province, suitably staffed, may be looked upon as a profitable investment by the Government and the Native Councils.

With the limited facilities available, experimental work directly for native agriculture has of nceessity been restricted to its simplest forms and to a small scale. An account of the work conducted in 1931 will be found in the Provincial agricultural reports below.

Extension Work in the Reserves.

This is done by the Native Agricultural Instructors (with occasional tours by the Agricultural Officer). The necessity for economies in 1931 entailed a reduction in the number of instructors from 80 to 62. While the value of the work of instructors is difficult to assess, it is undoubtedly great as the instructor in the course of his duties comes in contact with all people of importance and standing and a great number of others, while he is available on the spot if his services are required by any cultivator. He is thus the means of disseminating up-to-date knowledge and instruction and of giving advice either on points of general agriculture or on any matters of immediate importance, and his education and discipline allow him to be left in charge of such business matters as may arise from time to time, such as seed issues or storekeeping in time of famine. He also acts as an intelligence arm for the Agricultural Officer, who is unable to be constantly visiting all parts of his district, and his reports on such matters as the state of crops, food supplies, markets, pests and diseases are of great value.

The Agricultural Officer himself takes every opportunity afforded by safari or by meetings to make contact with individual natives. In addition, contact is maintained with all educational institutions in the district by occasional visits and by regular monthly letters of advice on agricultural matters.

A great deal of the time of the Agricultural Officers and their Instructors was devoted in 1931 to the locust campaign and to the organization of replacement of destroyed crops others less susceptible to attack.

Native Agricultural Schools.

Information on the aims and methods of training adopted at the schools at the Scott Agricultural Laboratories, Nairobi, and the Native Agricultural School, Bukura, Central Kavirondo, will be found in previous reports of this Department. The following table will be of interest :—

PUPILS AT SCOTT AGRICULTURAL LABORATORIES (NAIROBI) AND BUKURA (CENTRAL KAVIRONDO) SCHOOLS

	Number of Pupils		Number sent out Trained	
	Nairobi	Bukura	Nairobi	Bukura
1923	21	..	..	..
1924	42	30	..	..
1925	43	32	10	..
1926	34	55	28	..
1927	42	45	..	9
1928	50	36	8	4
1929	48	32	24	20
1930	60	48	20	7
1931	60	51	14	14

No pupils completed the course at Nairobi in 1927, owing to the extension of the course from two to three years.

The following table summarizes the nature of employment obtained by apprentices who have completed their course of instruction at the two schools :—

Nature of Employment	Scott Agricultural Laboratories, Nairobi							Bukura				
	1925	1926	1927	1928	1929	1930	1931	1927	1928	1929	1930	1931
Agricultural Department Instructors, Local ..	8	14	..	7	14	10	4	..	..	7	4	9
Native Councils	..	..	..	..	..	..	..	9	..	8	..	..
Forest Department	..	..	..	..	2	2	..	..	..	..	..	..
Educational Work	..	3	..	..	2	4	1	..	2	..	..	1
European Farms..	..	..	..	..	..	1	1	..	..	..	1	..
Other Work	..	11	..	..	..	..	..	..	2	..	1	..
Returned to Native Reserve	..	..	..	1	6	3	3	..	..	5	1	4
Storekeepers, Local Native Councils	..	..	..	..	..	..	2	..	..	..	..	..
Alliance High School	..	..	..	..	..	..	3	..	..	..	..	..

Seed Issues.

Owing to financial stringency the expenditure on the purchase and issue to natives of seeds of superior varieties of produce by the Department was lower than in 1930. Local Native Councils made up for this deficiency by devoting considerable sums of money to the purpose. The requirements of the different districts are known early in the year and bulk orders are placed. With the institution of Local Native Council Seed Farms, this service is likely to be entirely displaced by local production of improved seeds.

SEED ISSUES—NATIVE RESERVES
FROM DEPARTMENTAL FUNDS AND LOCAL NATIVE COUNCIL SEED FARMS

SEED		PROVINCES								TOTAL
		Coast	Kikuyu	Nyanza	Nzoia	N.F.P.	Ukamba	Rift Valley	Turkana	
Maize, White	Bags	105	235	558	15	8	..	100	8	1,029
Maize, Yellow	,,	20	..	..	..	..	..	..	..	20
Wheat	,,	..	22	12	..	..	2	..	..	36
Beans, C.W.	,,	..	137	6	..	3	10	20	..	176
Simsim	,,	15	..	..	..	..	..	..	..	15
Ground-nuts	,,	..	..	6	..	½	..	..	..	6½
Field Peas	,,	5	46	7	..	..	5	10	..	76
Potatoes	,,	..	271	27	6	2	10	15	..	321
Njahi	,,	..	..	2	..	..	..	..	..	2
Cowpeas	,,	7½	..	1	..	½	..	..	..	9
Rye	,,	..	..	2	..	..	..	..	..	2
Vegetable	Lb.	..	8	25	..	3	2¾	2	..	41¾
Wimbi	,,	..	..	80	..	100	..	2	..	182
Ginger Roots	,,	..	..	6	..	..	..	..	..	6
Lucerne	,,	..	..	..	..	36	..	..	..	36
Cassava Cuttings ..	,,	..	350	..	..	..	..	350	..	700
Coco-nuts	,,	..	..	..	..	100	..	..	..	100
Date off-shoots	,,	..	..	..	..	20	..	..	..	20
Cotton (tons) (provided free of charge by Ginneries)	..	3	..	162	..	..	..	..	..	165
Fruit Trees	..	8	..	24	..	..	..	32	..	64
Fruit Trees, Seedlings ..	..	..	..	5,129	..	..	..	12	84	5,213
Tree Seedlings	..	..	122,100	..	..	..	..	..	..	122,100
Banana Suckers	..	..	..	..	50	..	..	200	..	250
Buckwheat	..	..	..	37	..	..	..	..	..	37

SEED ISSUES—NATIVE RESERVES

SUPPLIES OBTAINED BY LOCAL NATIVE COUNCILS THROUGH THE DEPARTMENT OF AGRICULTURE

Seeds		Provinces				Total
		Coast	Kikuyu	Nyanza	Ukamba	
Maize, White	.. Bags	..	50	270	..	320
Maize, Yellow	.. ,,	60	..	..	30	90
Wheat ..	.. ,,	7	31	22	2	62
Beans, C.W.	.. ,,	10	91	15	17	133
Simsim ..	.. ,,	6	..	..	½	6½
Ground-nuts	.. ,,	8	..	30	1	39
Potatoes ..	.. ,,	..	..	44	..	44
Cowpeas ..	.. ,,	2	..	..	..	2
Pigeon Peas..	.. ,,	2	..	2	..	4
Rice	.. ,,	..	..	10	..	10
Vegetable ..	.. lb.	..	..	29	69¾	98¾
Wattle ..	.. ,,	..	..	400	..	400
Forest Trees	.. No.	..	..	..	18	18
Sorghum ..	..Bags	5	..	..	..	5

In addition to the above, supplies of seed valued at approximately £386 were issued in the South and North Kavirondo and Nandi districts for replacement of crops destroyed by locusts.

Agricultural Shows.

The schedule of the show of the Royal Agricultural and Horticultural Society of Kenya held at Nairobi in January included numerous classes for native produce. Entries far exceeded anticipations and competition was keen. A most successful show was also held at Mumias, in North Kavirondo, in February. The thanks of this Department are due to merchants of Nairobi and Kisumu who kindly contributed gifts of implements and other farm equipment as prizes.

Provincial Reports.

Kikuyu Province.

Seasonal Conditions.

Weather conditions and the factors influencing them vary considerably through the Province, but taking the year as a whole, they have been generally favourable. The short rains of 1930 were good, and the early months of 1931 gave good maturing weather to the short season crops. In the south the long rains started early in March, and early planting was possible, further north, in Embu, the rains were later, but were too much concentrated in April, while in Meru the precipitation was below average, but was well distributed throughout April and May. The cold weather months of July and August had less than the usual amount of mists in the northern districts, resulting in the countryside being considerably drier by September than is normal.

The short rains of 1931 were on the whole good, although somewhat patchy on the Aberdares, and in Embu and Meru they were considerably above normal, the fall in Meru during October being exceptionally heavy causing some waterlogging and washing out of seed, necessitating replanting. The rains stopped abruptly early in December.

Crops.

In general the long rains season was good for cereals and the harvest was expected to be rather above normal. Locust attacks over the whole of the province, however, did considerable damage and maize yields were irregular and considerably reduced except in the furthest parts of Meru, where excellent crops were obtained. The months prior to the short rains, when much maize is normally planted in the higher locations, saw continued and severe damage being done by locusts to young maize, fields being planted as many as four times. One result of this damage was that many natives decided not to plant maize in this season.

As a result of locust damage all over the country, and the incidence of food shortage, export from Kikuyu districts was restricted and allowed only under permit. The demand was so great, however, that permits were given for considerable quantities. In Kiambu district this amounted to about 620 tons monthly. These exports in general supplied the European farms in the neighbourhood and in a similar way, Fort Hall and South Nyeri districts exported to their neighbouring settled areas, but in parts of Meru, where excellent crops were obtained, little or no export took place owing to distance from markets and consequent heavy transport costs.

Organized seed issues, seed selection and propaganda have done much during the last few years to improve the quality of maize grown in the province. Individual officers comment on this as follows :—

> The whole stamp of maize in the Fort Hall District has improved out of all knowledge during the last three or four years. In some locations it is nearly up to the standard of K2.

> The quality of the maize (in Kiambu) continues to improve through seed selection. The percentage of coloured grains is gradually being lowered and in certain locations it is common to find the quality practically K2.
>
> The maize offered (in Meru) eventually reached a high standard of cleanliness.

In the main maize exporting areas of Kiambu, Fort Hall and Nyeri this crop has to a very large extent replaced millets and sorghums, but in the more distant areas, these are still very important crops. Much damage was done during the year to these crops by locusts.

Beans of the Canadian Wonder type are by now the most important pulse in the southern part of the province, and large exports take place every year. Natives are responding to the demand for pure samples and the quality of the bean exported is very high. In the northern half of the province, however, Canadian Wonder is not yet the dominant pulse, Njahi (*Dolichos lablab*) and pigeon pea (*Cajanus indicus*) being the most important. The latter suffered severely from locust attacks during August and September, the bushes being defoliated and having even the bark eaten off.

The short rains saw a tremendous increase in the quantity of pulses planted, owing to the natives' fear of locust attacks and consequent loss of cereal crops, and to intense propaganda by officers concerned. The policy was justified by the severe damage to cereals that occurred, while pulses were comparatively untouched.

Among root crops grown in the province English potatoes are gaining increased importance. Agricultural Officers report as follows :—

> In Kiambu, this crop shares with wattle the second highest place as regards export and in addition very large quantities are sold from house to house and by auction in Nairobi. The area around Escarpment and Uplands is the principal producing area. An Indian trader at Escarpment handles large quantities for export to Uganda and Bombay. The variety grown is the old British Queen imported up to 1922. Considering the number of years this variety has been grown the yields are remarkably high.
>
> This is a crop of increasing importance in both South Nyeri and Fort Hall districts, and efforts have been made to increase the area cultivated and to issue a better type of potato.

English potatoes are grown by many of the natives in the upper locations of Embu.

Improvement is required in the methods of digging; much damage is at present being done by faulty choice of tools and careless storing, grading and packing for export.

Other root crops grown which are very important as food supplies, especially in years of severe locust infestation, include yams, sweet potatoes, Colocasia and cassava. The first-named is subject to mealy-bug which is slowly spreading northwards through the province, and yam cultivation in parts of South Kikuyu has been given up, while the area in Fort Hall is being reduced every year. Sweet potatoes have been grown in the past few years in very large quantities as a famine standby, but in the south its use as a human food is dying out, the crop being planted mainly for stock feed. Much work has been done in increasing the use of cassava in Emberre and other parts of Embu and it is now a crop of major importance there.

Vegetables are an important export crop in Dagoretti. The exports in 1930 and 1931 were 738 and 813 tons respectively, the latter valued at £6,000, and consigned mainly to Mombasa, Nairobi and Uganda. In other districts the use of vegetables in the natives' own diet is constantly being encouraged and steady increase is noted.

Wattle, both black and green, is of great importance in the higher altitudes in the south, where in some parts increases of as much as 30 per cent per annum are observed in the area planted, and whence large exports are made either as green bark to factories or as shipments of dried bark. Steady improvement is taking place in the quality of bark offered, but further advance is required. Depression caused two factories to close down and native suppliers in the areas affected were left without a local market for green bark and had to resort to drying the bark. In other districts wattle is not advanced enough yet to give an export trade, but much use is made of it for building and firewood.

The period of deforestation in this province has now passed and natives are planting up large areas of gums as building and fuel supplies, and replanting of indigenous trees is also taking place. Organized tree nurseries are now considered an essential part of Local Native Council activities.

Marketing.

This year has seen a great change in the trading outlook of the Kikuyu in the great exporting areas of Kiambu, Fort Hall and South Nyeri. Previously the greater part of the trade in all commodities in these areas (as elsewhere) had been in the hands of the Indian trader and this system with its indiscriminate buying regardless of quality at a uniformly low price leaves much to be desired. Tentative marketing schemes were organized at Kiambu and Karatina. Associations of producers were formed which, with the help of Local Native Councils in erecting or leasing godowns at railway stations, sold their produce in bulk through a commission agent. The Kiambu scheme was reformed in December as the Kikuyu Native Producers' Co-operative Society (Kiambu) and a sole buying agent was appointed, while the Karatina scheme was reorganized with a buying agent, without the formation of a co-operative society. At Fort Hall a start was made by associated marketing pending the formation of the Fort Hall Native Producers' Co-operative Society. These associations are under the close supervision of both Administrative and Agricultural Officers and considerable success has been achieved by the end of the year.

Marketing conditions in the northern districts, Embu and Meru, are quite different. These areas of production are so far from the railway that with the present low prices for maize and beans, the heavy costs incurred by long road transport (30 to 120 miles) give the crops little or no actual cash value to the producer. The southern part of Embu district which is nearest the railway, exported considerable quantities of food, but this was due in part to the general shortage of maize towards the end of the year, which raised its price to about Sh. 2/50 per load of 60 lb. at Embu. Meru's natural market is to the north and a through road from the furthest part of the producing areas of the district to the Northern Frontier Province roads has been cut and is expected to facilitate trade.

Seed Farms, Nurseries, etc.

This year has seen the consolidation of the work of seed bulking in large centrally placed seed farms, which are financed by Local Native Councils and managed by the Agricultural Officers of the various districts. In Kiambu district there is one seed farm and a few small seed-bulking plots. In Fort Hall there are three seed farms, in South Nyeri three, in Embu two and in Meru two. Each farm is under the full time control of a Native Instructor with a permanent labour staff, and daily diaries of the work are kept. The main crops planted are maize (Muratha), potatoes, beans and field peas and in general good yields were obtained although the crops suffered severely in places from locusts.

Large quantities of selected acclimatized seed were issued during the year from the farms, the rejected grain being used for feeding or being sold to assist the farm's finances, and these seed issues have now been put on a more organized basis. Steady and thorough replacement of seed location by location is aimed at, rather than thinly spreading good seed over a large area. In Fort Hall, South Nyeri and Embu districts the following issues were made: maize, 245 bags; wheat, 33; potatoes, 231; peas, 43 and beans, 137 bags.

In conjunction with some of these seed farms the Department manages vegetable, tree and fruit nurseries, and poultry establishments and at the end of the year there were eleven of the former and four of the latter. The trees most commonly grown and issued are *Eucalyptus saligna*, *E. citriodora*, *E. globulus*, *Cupressus macrocarpa* and *Jacaranda mimosæfolia*, and of these 100,000 were issued in Fort Hall and South Nyeri and 22,000 in Embu.

Experimental Work.

The following experiments and trials were carried out at the Scott Agricultural Laboratories:—

Mixed native planting *vs.* separate planting. The average yields in pounds per annum over three seasons are:—

	Maize	Wheat	Beans (C.W.)	Potatoes (Eng.)	Peas
Separate	1,900	1,484	958	8,532	918
Mixed	1,254	1,609	657	6.659	745

This experiment is being continued, introducing the important factor of spacing.

Pumpkins.—Indigenous and imported acclimatized pumpkins were grown and it was found that the former yielded ten times the crop of the latter. After selection a yield of over twelve tons per acre was obtained.

The opportunity is offered on the seed farms, in the absence of experimental stations, for experimental work on a small scale, and advantage is taken of this in the carrying out of cultural trials, seed selection and similar work. In plots at Embu the long rain trial crops suffered severely from locusts, and Niger oil, linseed, simsim, White Cango maize, buckwheat, awned bulrush millet and wheat were all more or less affected. Sword beans gave good germination and healthy but slow growth. In addition to the above, Tepary beans and Madagascar butter beans were planted in the short rains.

Rice trials have been laid down in a swamp at Itabwa (Embu) and four varieties from the Federated Malay States were planted in the long rains. One variety failed but two promise a fair yield in 1932. In the short rains, the Halkaduwi and Goda-ol rice varieties from Ceylon were sown and germinated rapidly, the former promising to be an excellent crop. The swamp is mainly to demonstrate to natives in the locality (which is hot and with erratic rainfall) the benefits of swamp irrigation in ensuring constant food supply.

The Agricultural Officer, Embu reports :—

> In the short rains experiments were laid down and at Embu these comprised a random block variety trial of beans for yield and earliness of maturity and a duplicate strip demonstration to judge the merits of the equal spacing (in lines) of maize and beans, whether separately or in alternate rows, as against the random mixed planting practised by natives. At Chuka they consisted of a latin square bean variety trial and a random block maize spacing experiment. Good results are expected at harvest time early in 1932.

Animal Husbandry.

The Kikuyu natives are essentially agriculturists. Little economic use is made of the many cattle and small stock they possess, and in the south part of the province difficulty is experienced in the supply of grazing. This suffered in common with crops from locusts during the year and in places by September and October recourse had to be had to hand-feeding of cattle. This tended to encourage the natives to make some use of the milk and manure, but little is done in this way as yet, although from the locations near settled areas large quantities of boma manure are sold to European farms.

The usual amount of sickness was prevalent amongst all kinds of stock, but in spite of this, numbers generally have been maintained and goats have increased.

Progress is being made in the better flaying, dressing and drying of hides, demonstrations of which work were given by officers and members of hide drying firms from time to time. Local Native Councils have erected a number of hide drying bandas at various market centres.

The rearing and issuing of poultry and sittings of eggs have been referred to above as part of the work on seed farms and in most places an improvement is to be noted in the quality of the poultry seen about native homesteads. There is scope in some districts for egg marketing schemes and these may be started in 1932.

General Progress and Development.

The steady progress and improvement of the last few years in the quality of crops grown and offered for sale has been maintained, and in some parts in spite of locust damage exports have increased; these improvements are particularly marked in those areas where the native producer is in close contact with markets and export facilities. The Agricultural Officer, Fort Hall, reports on recent development :—

> Returning to Fort Hall after an absence of more than three years, the writer was astonished at the amount of progress that had been made in agriculture.

The greatest advance last year was in the attitude towards marketing and the establishment of co-operative societies and similar organizations, which have been dealt with above. In other, poorer areas with less facilities for engaging in trade, progress has been less marked, and the Agricultural Officer, Embu, sums up the position as follows :—

> The locust attacks and the anti-hopper campaign of the last six months have overshadowed all other work and much that might have been done in normal times in the development of the reserves has had of necessity to stand aside at such a time of grave danger. Much attention has had to be devoted to the encouragement of the native not only in combating the locust, but in planting such crops as might not be destroyed, in increasing his cultivation and in opening up old and making new irrigation furrows for the quick production of food. It may be said with confidence, however, that the agricultural development of this part of the reserve is going steadily forward.

Another change which has recently been more marked is in the attitude of the natives towards Government agricultural activities, and particularly to the work of the

Agricultural Officer and to seed farms. The Agricultural Officer, Fort Hall, reports :—

> No longer is he (the Agricultural Officer) regarded as a person deputed by Government to spy out the good land, but he is regarded as one to whom the native may go for assistance. Where four years ago natives refused to take good seed or to allow an instructor to show them how to plant their shambas properly the same natives now clamour for good seed and request that the instructor may show them how to plant.

Similarly, it is reported from Embu :—

> A welcome change has been taking place in the attitude of a certain section of the population in relation to agricultural services and it may safely be said that these have now the confidence of all but the most stupid or reactionary of the people. The seed farm is now looked upon as a definite asset.

A note of warning is uttered by the Agricultural Officer, South Kikuyu, on the question of congestion and the fertility of the soil :—

> Numbers of squatters have returned to the reserve which, together with the increase in population, is causing congestion in certain locations where practically all the land is under cultivation. There can be no doubt that there is an increasing tendency for natives to keep their cows near their holdings and to manure the land, but this is by no means general as yet.

The following further extracts are taken from the report of the Agricultural Officer, South Kikuyu :—

> *Local Native Council Agricultural Committee.*
>
> The above committee, of which the Agricultural Officer is chairman, was formed during the year and has been of immense value in getting on with agricultural matters of pressing importance. The committee puts up schemes for the furtherance of agriculture in the reserve and for the allocation of Local Native Council funds put at its disposal.
>
> At meetings held in the Mukinyi Division natives were anxious to have a seed farm, but wanted it on forest reserve, which would only be suitable for the bulking of beans, peas and potatoes. One of the Elders said that, just as a few years ago they refused issues of seed and now wanted them, so in a few years perhaps they would be willing to set aside land for a seed farm.

NYANZA PROVINCE.

Seasonal Conditions.

With the exception of the country bordering Lake Victoria, where the rainfall is normally sparse, weather conditions were extremely favourable for the growth of crops throughout the year. The long rains commenced well up to time, and in March averages of 9½, 13 and 11¼ inches of rain were recorded in the higher parts of South, Central and North Kavirondo respectively. Beans, simsim and other crops planted from August onward were favoured with excellent weather and by the end of the year the rainfall in some of the higher locations had exceeded that of normal years by 15 inches.

Crops.

Conditions were very favourable for the preparation of land and germination of seed and large areas were planted with maize, sorghums and eleusine millet (wimbi), the early-planted main staple crops. Prior to the arrival of large swarms of locusts in the lower-lying parts of the province in April, prospects were very favourable. Cereal crops were damaged in varying degree, at different stages of growth, many being completely destroyed in the early stages by locusts. Natives did excellent work in combating the pest in its early stages, but after repeated invasions they became disheartened and ceased to replant maize. Being accustomed to plant maize and other main staple crops at certain dates it was difficult to overcome prejudice and induce them to plant at other times. With the object of averting famine large areas of sweet potatoes and cassava were planted. It was reported that over 40,000 acres of these crops were planted in Central Kavirondo alone. Small areas in the highest locations of Central Kavirondo escaped severs infestation and produced small surpluses of cereals, pulses and sesame (simsim) for export to other parts of the Province.

During the early months of the year it became probable that food supplies in parts of South Kavirondo would be very limited, and funds were advanced by Government for the purchase of seeds for the replacement of crops destroyed. At a later date maize meal was issued for work performed. Considerable quantities of foodstuffs were imported to meet demands, and further to improve the situation the export of cereals from the province was prohibited. No real privation occurred.

The Cotton Crop of 1930–31.—The crop was a small one, but as natives have now realized the necessity for greater care in packing and sorting, the quality of the bulk showed a great improvement. The total crop amounted to 902,752 lb. of A quality, and 16,215 lb. of B quality, seed-cotton. The Agricultural Officer of the district reports as follows :—

> The opening prices were Sh. 7 per 100 lb. at stores and Sh. 8 at ginneries. These were very discouraging prices and it is believed that a fair amount of cotton was taken across the border to Uganda, where prices were slightly higher. Prices improved later to Sh. 10 and Sh. 12 respectively.

As the Nambare ginnery did not operate, the entire crop was handled at the Sio and Malakisi ginneries.

The Cotton Crop of 1931–32.—In spite of much of the time of Administrative and Agricultural Officers being occupied with locust destruction an intensive campaign was made for extending the acreage under cotton and 162 tons of seed were issued for planting. The spacing of plants was improved by the use of spacing sticks. Planting began in June, reached its maximum in July and continued into the beginning of September. June plantings gave the best yields. Excessive rain in November and December retarded picking and hail caused slight damage. With these exceptions, the weather was very favourable for the cotton crop. It was anticipated that the output would exceed that of the two previous seasons.*

Issues of Seed and Fruit-tree Seedlings.—Particulars of quantities of seed supplied for the improvement of quality and increase in yield of crops have already been given. Local Native Councils of the province provided over £350 for this purpose, in addition to Government issues. Some 2,300 fruit-tree seedlings were grown and distributed from Bukura, and over 2,000 small packets of vegetable seed were prepared from seed bought by the Local Native Councils.

Seed Farms.

For the provision of acclimatized seed in bulk arrangements were made for the establishment of Local Native Council seed farms at Kisii, Maseno and Kakamega to augment the local production of these which has been confined to the training school at Bukura for several years.

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* The final return for the crop was 2,166,352 lb. of seed-cotton, an increase of 136 per cent over the previous crop and closely approximating the 1928-29 crop of 2,259,497 lb.

Tree Planting.

The planting of Siala and Iron Bark trees was encouraged as the timber of these is useful for building purposes and is not very susceptible to attack by white ants. It is also useful for fuel. The Local Native Council, Central Kavirondo, established a number of nurseries and raised and distributed large numbers of seedlings of gums, Grevillea and Cupressus. Native Agricultural Instructors gave instruction and assistance with the planting of these trees.

Experimental Work.

Trials of new varieties of crops were continued during the year at Bukura. Yields were affected by damage caused by locusts. A brief summary of results obtained is taken from the Agricultural Officer's report :—

Groundnuts.—Seed of Virginia Bunch obtained from Tanganyika Territory and Spanish Bunch, Mumbo, Shirati, Butere and Java White, grown at Bukura, was planted 20th March on one-twentieth acre plots. Spanish Bunch gave a yield equal to 1,632 lb per acre, compared with 1,555 for Jumbo, 1,237 for Shirati (the standard variety of the district) and 179 for Java White. Subsequent plantings demonstrated that it is probable that the best yields would be obtained from August sowings.

English Potatoes.—The Baron gave better results than any variety yet tried at Bukura. It matured in 101 days, compared with 115 for later varieties, ripened well and looked like being a superior keeper. It is probable that early maturing varieties are the most suitable for the Nyanza Province. Yields per acre and order of maturity were as follows : The Baron, 11,250 lb. ; Kerr's Pink, 6,250 lb. ; Alannah, 6,000 lb. ; Great Scot, 4,125 lb. ; Arran Banner, 3,250 lb. ; Tinwald Perfection, 3,312 lb.

Soya Bean.—Yields per acre and number of days required to reach maturity were as follows : Ludwig, 95 days and 417 lb. ; Sutton's F and B, 80 days and 296 lb. ; Dixie, 95 days and 271 lb. Otootan made good growth and appeared to be a promising variety, but was damaged by locusts.

Dolichos Hosei.—Plants were transplanted from the seed bed, and grew well, roots being formed at the nodes of the stems. Nodules were produced on the roots and as the plant has a creeping habit it should be useful as a cover crop on slopes in coffee.

Mat Bean (*Phaseolus aconitifolius*).—Nodules were not visible on the roots. At three months growth was nine inches high and erect, but by four months it had become spreading and was more desirable for cover crop purposes.

Centrosema pubescens.—Nine months after planting the growth covered the land. When opportunity occurs the stems climb permanent crops. Nodules were formed on the roots. This should be a good cover crop.

Ginger.—A sample of ginger obtained from Uganda and planted at Kajula, near the shores of the Lake Victoria, at an elevation of approximately 3,800 ft. made good growth. As it is probable that conditions in that area and on the Kavirondo Gulf may be suited to it, further issues will be made in 1932.

Sorghum Millet.—Nineteen varieties were tried, of which seven local ones gave good yields from the first or from ratoon crops. Seed from America (eight varieties) and the Soudan (four varieties) may give better yields when acclimatized and these will be tried again in 1932. The local variety, Okunja, gave the best return and yielded 2,448 lb. per acre.

Of other varieties, trials of which were not concluded at the end of the year, or which were destroyed by locusts, the following appeared promising: Pigeon Pea, var. Era: *Phaseolus calcartus*; Russian lentils; Cowpea—a variety obtained from Morogoro; varieties Early Butter and Calabash Leaf of sweet potato obtained from Rhodesia; Mwala yams (*Plectranthus tuberosus*); linseed; lemon grass.

Animal Husbandry and Poultry.

Grazing was damaged repeatedly by locusts, but owing to the ample rainfall there was no scarcity of fodder. The burning of grass as a locust control measure was discouraged as it was desirable to maintain the milk supply. Considerable time was spent in the further promotion of the shade-drying of hides and skins. Hide-marketing Rules, which came into force on 26th June, operated to the advantage of the industry as a whole, but after a few months certain buyers found ways in which to evade them. Buyers anxious to assist in the promotion of the trade by encouraging the preparation of better hides attended sales organized for the purpose of securing better prices for superior hides, but these sales were not a complete success as natives were unaccustomed to this method of selling and many refused to dispose of their hides at these markets.

General Progress and Development.

Many miles of excellent murram road were constructed in South Kavirondo and roads were improved in the other districts. The Kisumu–Yala branch line was extended to Butere. Facilities for the marketing of produce improved accordingly. Cash available for the purchase of farming equipment by natives was very limited, and although fair during the early months, trade in implements declined to a minimum later in the year. Sales effected included ploughs, 122; plough shares, 436; trek chains, 287; yokes, 144; harrow sections, 8; cream separators, 85; Colonist mills, 19; other mills, 2; millstones, 9.

The year was one of very considerable difficulty and hardship for natives due to low prices and destruction of crops by locusts. Although prices had a tendency to rise from June onward producers reaped but little benefit as they had only cotton and simsim to offer for sale and the production of these is limited to certain areas. Progress during the year, therefore, is to be looked for, not in any increase in production, but in improvement of the quality of the crops and in the methods of cultivation (chiefly the use of improved implements and the better spacing of crops) and there can be no doubt that the sustained efforts of the Agricultural Officers in the three districts, with their Native Instructors, together with the issues of seed of improved varieties of crops suited to the areas, are being reflected in steady progress from year to year, among a people hardly yet capable of appreciating the value of any change from their time-honoured practices.

COAST PROVINCE.

Seasonal Conditions.

The rainfall during the year was badly distributed. The long rains commenced late and an abnormal precipitation in May was followed by a very dry spell during the June–July growing period. Heavy downpours fell at the end of July, and the weather continued showery up to September.

The short rains were also late as little fell until the end of November. These were then of brief duration on the coast itself, although somewhat better inland.

Crops.

Maize and sorghums planted for the long-rain season in the Sabaki River area gave good yields, but owing to the unfavourable weather conditions these were poor elsewhere.

Locusts were present, but did not cause much damage to cereals until the end of the year. In the short rains fair crops were in prospect at the end of December where early planting had been adopted.

Except where damaged by the deluge of rain, mentioned above, leguminous crops planted for the long-rain season gave satisfactory results, and good crops of cowpeas and green gram were reaped. A cash bean crop is needed for this area and initial results obtained with Tepary bean for this purpose were promising.

It is customary for simsim to be planted in May and November. Many plantings gave satisfactory yields, but the short-rain crop, which is not harvested until early the following year, was not promising at the end of December.

The area planted with cassava in this province could be extended with advantage, but varieties commonly grown at present do not mature early and many are susceptible to mosaic disease. Several varieties were imported and yield trials conducted. These trials will be continued, but as it was not advisable to wait until results became available before propagating local varieties for distribution, one known as Binti Athman, obtained from Zanzibar, was planted for multiplication for the Malindi and Digo districts, where local stocks are particularly susceptible to mosaic disease.

The Cotton Crop, 1930–31.—Owing to the inadequate rainfall of 1930 this crop failed, and the yield of 29,500 lb. of seed-cotton compared very unfavourably with those of the two previous seasons, which were 510,500 lb. and 202,700 lb. respectively. Owing to the depressed state of the cotton market very low prices were obtained. Buying opened at Sh. 7 per 100 lb. for first quality seed-cotton, but Sh. 8 was paid from the middle of the season onward.

The Cotton Crop, 1931-32.—The Agricultural Officer reports as follows :—

> As expressed in last year's report, it appeared desirable to complete the cutting out (of the old plants) earlier in March in order to obtain a sufficiently long dead season. It also seemed probable that if earlier planting were general, better crops would be obtained. With this in view meetings were held to bring this to the notice of natives and seed was issued as early as possible. A time of planting experiment

was also conducted at Kibarani. As the local type of cotton had degenerated somewhat, three tons of seed of the variety N.17 from Uganda were obtained by the Department and issued at Malindi and Ganda for trial and with the object of bulking the seed and replacing local strains if results were satisfactory. The cotton season was a very good one and although particulars of the total output will not be available until early in 1932, returns of seed-cotton bought up to the end of December were very satisfactory. Purchases were as follows: first grade, 454,114 lb., 2nd grade, 31,607 lb., making a total of 516,721 lb.*

Buying opened at Sh. 7 per 100 lb. of seed-cotton of first grade and was raised to Sh. 8 later in the season. The price for second grade cotton was Sh. 4. Satisfactory features of the crop were the small proportion of 2nd grade cotton, steady improvement in cultural methods and the adoption of early planting.

Dry conditions in 1930 and the early part of 1931 were felt in the sugar plantations at Ramisi. A good recovery was made with the rains and the remainder of the year was favourable. A peculiar effect was observed in some fields, where rain caused rapid growth of drought-affected shoots instead of sucker growth, which produced cane difficult to handle in the factory.

The early months of the year were unfavourable for coconuts. All plantations were in poor condition and many weak trees must have died during this period. The palms revived after the commencement of the rains, and it was noted that the dry season of 1930 was followed by heavy crops in 1931. The price of copra was low and work on estates was reduced to a minimum.

The price of sisal was also low and in consequence development of sisal estates was suspended. Extensive economies in labour became essential and output was reduced.

The propagation of Cashew nut seedlings was undertaken for distribution to natives with the object of building up an export industry and by the end of the year some 6,000 seedlings had been distributed. European firms have been approached to introduce the necessary machinery for decortication and full oversea market information has been obtained.

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* Subsequent to the preparation of this report a final return of 627,786 lb. of seed-cotton purchased was received.

Seed Farms.

The need for economy limited the establishment and expansion of activities of this nature. The acreage under cultivation at Kibarani and Ganda was increased as much as funds allowed, and with the aid of money provided by the Local Native Council, Digo District, land was opened up at Kwale. Preparations were made for the establishment of a seed farm at Gotani in the Kilifi District in 1932 and it is hoped that increased supplies of acclimatized seed will be made available by these means in 1932. Particulars of seed issues will be found in the appropriate table.

Experimental Work.

A number of crops has been under trial at Kibarani, Kilifi, during the past season and notes on the more promising kinds are given below. Others, which failed partially or entirely, will be tried again next year.

Green Manures and Cover Crops.

Canavalia ensiformis (Sword bean).—A vigorous, semi-erect perennial. Resists drought well, forms a good cover and crops heavily. Not recommended as a green manure proper but is a promising cover crop and is under further trial with sisal and coffee.

Calapogonium mucunoides.—Forms a close cover in six months about nine inches thick. In other countries its useful life is three to four years but there is some doubt whether that will be the case here.

Dolichos Hosei.—Quick-growing creeping plant forming a close cover, three to four inches thick in three-and-a-half months. Heavy leaf-fall with onset of dry weather.

Centrosema pubescens.—A slow-grower, a cover not being complete after six months. Moderate leaf-fall in dry weather.

Pueraria phaseoloides.—Very slow in the seedling stage but forms a thin cover in five months; some leaf-fall with dry weather.

The above are promising perennial cover crops, observations on which will be continued.

Phaseolus aconitifolius.—An annual, which forms a dense tuft in the first month and then spreads to make a cover one foot thick. Ready to turn in at three months and seed can be harvested after four months. Should prove very useful as a quick-growing green manure.

Amongst indigenous leguminous plants under trial, special mention should be made of a climbing bean which may prove useful amongst coconuts though unsuitable for sisal. A species of *Clitoria* and several of Tephrosia may also prove of value. Others show too great a tendency to woodiness.

Native Crops.

Durum Maize.—A four month dent maize from Australia, which shows marked resistance to streak disease. Cobs large and tightly packed but bracts rather loose. Very promising.

Yellow Menado Maize.—A three-and-a-half month flint maize subject to streak. Cobs small but well sheathed and in a normal year yields should be heavy.

Awned Bulrush Millet.—Of three varieties tried, one from Tanganyika proved very good and yielded at the rate of 800 lb. per acre. Bulking for distribution will be done as quickly as possible.

Kavirondo Sorghums.—From a number of varieties tried, five have been selected for further trial.

Kinyali Sorghum.—A white Tanganyika variety, yielding large, heavy heads, which are ready in about four-and-a-half months. The season is rather long for the Coast.

Bonganhilo Sorghum.—A red variety from Tanganyika, yielding moderate-sized, well-compacted heads. Very promising.

Cassava.—A number of local and imported varieties were tried with particular reference to the incidence of mosaic disease. Six varieties have been selected for apparent complete or partial resistance to this disease and are now under trial. A Seychelles variety has also been selected for its quick-maturing character.

Black Gram.—A useful crop introduced from India. One plot yielded at the rate of 450 lb. per acre.

Cotton.—In addition to an issue of Uganda No. 17 seed at Malindi in order to improve the local cotton, a trial of another Uganda variety, S.G.29, was begun at Kibarani. This is very definitely superior to the local type and further work will be done with it.

A time of planting experiment for cotton was begun at Kibarani with a view to ascertaining the optimum time of planting. Owing to the lateness of the season it was not possible to start planting as early as had been hoped. It was expected that the first sowing would be made at the end of March and then at approximately fortnightly intervals until mid-July. Actually the first sowing was delayed until the beginning of May, giving only five sowings in all. No results are given as yet, for the experiment is to be continued for some years; this year the seasonal conditions were too unusual to serve as a guide. It need only be said that early plantings in the rains gave better results than late plantings.

Other Crops.

Sunflowers.—Three varieties were tried, of which the best was the Large Black, which yielded at the rate of 1,500 lb. per acre.

Bermuda Grass.—This grass was tried as a lawn grass and has proved very drought-resistant and quite suitable for the purpose.

Shelter Belts.—Cashew nut trees have been planted as a wind-break. They are quick-growing and have the advantage of growing vigorously on the Coast and giving a subsidiary crop.

In addition to the above, work has begun on trials of a number of permanent crops.

The thanks of the Department are due to Mr. W. G. Lillywhite for his assistance. In addition to providing the land for the trials, he has helped in a number of other ways to further the progress of the work.

Pests and Diseases.

Mention has already been made of locusts. Apart from this the most important pest in the province during the year was stalk-borer, affecting maize and sorghums. The uncertainty and irregularity of the two rainy seasons make it difficult to obtain a close season for the planting of crops affected. Cleaning-up campaigns were conducted by District Commissioners of the Digo and Tana River districts between the harvesting and planting seasons, when a minimum of young maize is standing, and it is hoped that success will attend their efforts. Streak disease was very prevalent in maize, root disease in groundnuts, and reference has already been made to mosaic disease of cassava.

General Progress and Development.

Communications were improved by the opening of the Nyali bridge connecting Mombasa with the mainland on the north. The beneficial effect of bulk issues of seed maize distributed in the Kauma location and cowpeas in Sokoke was noticeable, but the most important feature of agricultural production of the year was the large increase in acreage under cotton. The yield of which will not be known until early in 1932. The foundation work for the crop improvement taken in hand during the year, principally experimentation and the establishment of seed farms, has been most promising, but it will be difficult to extend it without further staff, as the time of the energetic and keen Agricultural Officer at the Coast is now completely employed and many parts of the province remain without agricultural services. The possibilities of the province are uncertain as yet and a comprehensive economic survey is needed.

In concluding this section on Native Agriculture, a word may be said as to the potentialities of the reserves and the organization gradually being established for their agricultural development. The present depression has brought out the value to the country of the native farming communities more than anything else could have done. With most European industries so unfortunately sinking under the weight of the depression, the native peasant agricultural industries have been practically uninfluenced by it, for the very simple and important reason that cost of production is a negligible factor to the native peasant. They are the large, stable, productive element in the country and the development of the reserves that lies ahead, both in increase of production of exportable crops and in providing a wide market for many products of European farms and for imports, is likely at some future time, with the wealth of the European industries, to make this Colony a prosperous one. At present the Plant Industry Division is able only to give scant attention to the three large native areas, Kikuyu, Kavirondo and the Coast.

The necessary organization for the development of these reserves is gradually being provided. The factors of such an organization may briefly be described as, in order of priority: (1) the educational centre combined with the experiment station, from which proved crops and methods issue; (2) the district seed farm, for demonstration of these and centralized multiplication of seeds; (3) the local propaganda and instruction; (4) the organization of marketing. The extent to which each of these factors is provided will be largely apparent from this report. It need not be disguised that the provision, relatively to the needs, is scanty. The aim of the Department is to build up this organization as rapidly as circumstances will permit and no one who has the cause of the prosperity of Kenya at heart can fail to support the Department in its aims and its work for native agriculture.

CONCLUSION.

At the close of my first year in Kenya I should like to express my gratification at finding a staff working with me who show, with remarkably few exceptions, a devotion to their duties and a practical ability to handle the cultural and scientific problems which face the crop industries, of which, I feel sure, few Departments can boast. The large amount of work necessary and the restricted staff place a heavy burden on each one of them which none but enthusiastic workers can support in any sustained way. It is impossible to single out particular services or officers; all have my sincere thanks for their whole-hearted endeavours and for the character of their work.

H. WOLFE,
Deputy Director (Plant Industry).

Appendix I

ENTOMOLOGICAL SECTION

Annual Report, 1931.

By The Acting Senior Entomologist and Staff.

Staff.

The following officers constitute the staff of the Entomological Section of the Department of Agriculture :—

T. J. Anderson, M.A., B.Sc. (Edin.), F.Z.S., F.E.S.; Senior Entomologist.

H. Wilkinson, A.R.C.Sc., F.E.S., F.L.S.; Entomologist.

H. C. James, Ph.D., B.Sc., N.D.A., N.D.D.; Entomologist.

R. H. Le Pelley, Ph.D., B.Sc., A.R.C.Sc., D.I.C., F.E.S.; Entomologist.

F. B. Notley, B.Sc.; Entomologist.

T. L. McClelland, M.C.; Insectaries Manager.

The native staff numbers eleven.

The Senior Entomologist, until he went on leave on 7th July, and the Insectaries Manager were stationed at the Scott Agricultural Laboratories.

Mr. Wilkinson was stationed at Nakuru from January to March, after which he proceeded to Londiani to organize and take charge of a locust campaign in the Nyanza and Rift Valley Provinces. From July to the end of the year he was stationed at the Scott Agricultural Laboratories as Acting Senior Entomologist.

Dr. James returned from leave on the 7th May and was engaged on work of locust destruction until the 26th June; from then until the end of December he was stationed at Ruiru entirely engaged in work connected with the coffee mealy bug.

Dr. Le Pelley was engaged in the Kiambu–Limoru area in work connected with mealy bug, lygus and antestia and their control.

Mr. Notley was stationed in Sotik and has been engaged in work connected with locust control and investigation into pests of coffee in the Sotik–Kericho areas.

Travelling.—17,060 miles were travelled by the staff by car on Government service.

2,129 letters were dealt with.

LABORATORY AND ADMINISTRATIVE SERVICE.

470 specimens of insects, damaged plants and seeds were examined and reported on.

18,796 coffee beans submitted by inspectors and mills were examined with the following results :—

Undamaged or shrivelled	17,386
Antestia damaged	530
Butterfly damaged (*Deudoryx lorisona*, Hew.)	58
Moth damaged (*Thliptoceras octoguttale*, Feld.)	39
Stephanoderes damaged	676
Sophronica damaged	107
Total ...	18,796

181 consignments of locusts were received and numerous specimens from each were dissected and the state of development of the sexual organs reported on.

194 applications for permits to import plants have been scrutinized, amended or approved.

348 parcels of bulbs, vegetables and flower seeds, potatoes and fruit trees have been imported during the year.

Thirty-two consignments for export have been examined and reports given.

An exhibit was prepared and staged at the Agricultural Show held in Nairobi on January 3rd to 7th, and also at Eldoret Show on March 5th to 6th. Two meetings of the Coffee Planters' Union were attended. Meetings were attended at Kisumu, Kibos, Miwani, Songhor, Fort Ternan, Lumbwa, Londiani, Mau Summit, Kericho, Njoro and Rumuruti, and lectures given on the life history, organization and control measures to be adopted in respect of *Locusta migratorioides*.

PUBLICATIONS.

Seven bulletins and articles were published during the year (*see* general list).

LOCUSTS.

Huge tracts of country have been heavily infested by locusts, *Locusta migratorioides*, R. & F. This species of locust appears to confine itself to eating plants of the natural order, *Graminaceæ*, except during periods of dry weather when plants of other natural orders are attacked.

From September to the end of the year swarms of varying size of the desert locust, *Schistocerca gregaria*, Forsk., have been found with *Locusta migratorioides*.

Other species, such as *Phymateus viridipes*, Stal. (coffee locust), and *Zonocerus variegatus*, L. (variegated locust), have also been swarming to a small extent. Hoppers of the two latter have been found covering up to about one acre of ground in various parts of the Colony.

MAIZE STALK BORER (*Busseola fusca*, Fuller).

This pest has been on the increase during the year. On a few estates as many as 60 per cent of the maize stalks were infested by the borer. Experience has shown that the pest can be controlled by the application of good agricultural practice and planting the crop within certain well defined periods of the year.

The reports of the Entomologists concerned with work in the field are given below.

H. WILKINSON.

DR. LE PELLEY'S REPORT.

The chief pests in Kiambu during the year were antestia, lygus, and mealy bug. Considering the district as a whole, antestia and lygus were more serious than mealy bug, although severe attacks of this insect occurred on some farms. These attacks in most cases were effectively controlled.

Visits to Makuyu were made in January and March in connexion with the serious mealy bug infestation in that district. At one of these visits a lecture was given to the local planters' association, in which a trial of castor oil bands in the district was recommended. In Makuyu, and possibly elsewhere, the writer believes that the maintenance of bands in good condition all the year round is essential if occasional attacks of extreme severity are not to occur.

It is now possible to make a definite statement on spraying against mealy bug. The promise of spraying being of practical value given by the first experiments has not been fulfilled. Although two effective sprays were found, and the first experimental spraying on a fairly large area produced a decided improvement and enabled a more rapid recovery of the sprayed trees, yet further work showed that the conditions in which such a result may be obtained are unusual and unpredictable, and it was doubtful even in such a case whether the high cost of applying a contact wash was justified. It is now certain that spraying cannot prevent an epidemic attack when once this has begun, and although the good result of a more rapid recovery of an attacked area may in cases be obtained by spraying, it is advisable rather to concentrate all efforts and funds on the permanent maintenance of the bands in perfect condition. Further work with sprays against mealy bug is not contemplated and from the experiments already made it is not considered that there is any future for large scale sprayings against this insect.

ANTESTIA AND LYGUS.

Most of the year was spent in a detailed investigation of the value of a paraffin extract of pyrethrum against lygus and antestia. This entailed a large amount of field and laboratory work, together with advisory work in connexion with the method.

As notices describing the preliminary experiments appeared in the press, and as the method is now fairly generally well known and was applied commercially by planters against both these insects, with success, during the year, and further that technical papers describing the method in detail are shortly to be published, it is not necessary to give detailed description of the work in this report. At present its value is limited firstly by the fact that pyrethrum powder or extract of adequate toxicity is scarce and secondly by the fact that for adequate results the application needs to be made with considerable skill. It appears, from biological tests of locally grown pyrethrum powder, that when pyrethrum is produced locally on a more extended scale, the first limitation will be overcome. To overcome the second it will be necessary to employ the most intelligent labour available and to maintain efficient supervision. The writer has shown that with native labour the numbers of lygus can be kept below one per tree by this spraying.

Certain general collecting and breeding of coffee insects was continued during the year but no detailed work on any subject, with the exception of the above, was possible.

VISITS.

Four days were spent visiting coffee shambas and estates on the southern slopes of Kilimanjaro in Tanganyika Territory.

Three visits were paid to Makuyu in connexion with mealy bug.

Two visits were paid to Nyeri in connexion with antestia and lygus.

MEETINGS.

One Planters' Association meeting in Makuyu, and two Planters' Association meetings in Kiambu were attended.

ARTICLES.

Three articles on different questions connected with the pyrethrum extract spraying were published in the local press on lygus control, antestia control, and scorching of kerosenes.

LECTURE.

One lecture on mealy bug was given at Makuyu.

PAPERS.

Two technical papers, one on lygus, the other on antestia, were accepted for publication during the year, and preparation of a third on the pyrethrum extract spraying was begun. Departmental bulletins on these subjects will be published later.

Advisory visits were paid to farms in Kiambu, Limuru, Ruiru, Makuyu and Nyeri.

R. H. LE PELLEY.

MR. NOTLEY'S REPORT.

Work during the year has been considerably hampered by changes of station and by locusts.

Arriving at Songhor at the end of December, 1930, considerable travelling was entailed in obtaining a general impression of the district and its important pests. These appeared to be antestia, metadrepana (not present at the time), berry moth and butterfly, and in places stem borer, *Apate monacha*. A capsid, unidentified, was causing some uneasiness in certain shambas. Preliminary work was commenced on these pests, antestia and the capsid taking first place. A trial of an insecticide supplied by the Senior Agricultural Chemist against the capsid was attempted, with negative results.

During February a visit was paid to the Kericho–Sotik area with the Senior Entomologist, and the station moved to Mr. Fenwick's shamba in Sotik on March 1st. Here experiments were commenced on blossom-blackening. It was found that this was due to two causes, firstly a capsid (unidentified, but not *Lygus simonyi*) and secondly a fungoid or physiological cause. The two types of damage were unconnected and quite distinct in their symptoms, that by the capsid being similar to the damage caused by *Lygus simonyi* in the Kiambu district, the other damage being a blackening of the whole flower and ovary, without the typical lygus effect of the blackened unopened blossom standing away from the ovary on the style. The damage by capsid in the Sotik area was not very great; the other in some places was quite serious.

Experiments were continued with antestia, and work on a hitherto undescribed leaf-eating caterpillar, doing slight damage, but a potential pest, was commenced. The adult, a black and white moth, still awaits identification by the British Museum.

On April 27th orders were received to proceed to Kisii on locust work. During May and the first half of June locust destruction occupied the whole time. The latter end of June was spent in touring South Kavirondo for the purpose of collecting information on the first swarms and the hopper infestation, and of instructing the natives in bringing in information of any laying which might occur in the future. This was carried out in conjunction with the administration who were investigating the extent of famine relief necessary.

At the beginning of July orders were received to proceed to Londiani, to conduct experiments on a number of insecticidal and other methods of combating locusts. The results of these experiments, together with observations on locusts in South Kavirondo, were incorporated in a special Locust Report, part of which was published in Bulletin No. 21 of 1931. The experiments at Londiani showed that of all the locust destruction methods tried, arsenite of soda proved the most effective and very much the least expensive.

A return was made to Sotik in August, where work was immediately started on a leaf-eating caterpillar, which was doing considerable damage in the district. The species present was identified as *Metadrepana andersoni*, and an investigation of its parasites, of which nothing had been known, was commenced, with a view to their practical use in control.

The percentage parasitism in the field proved to be low, not exceeding 20 per cent in any collection made. The parasites belonged to the following families :—

Tachinidæ	7 species.
Ichneumonidæ	3 species.
Chalcididæ	1 species.
Other Hymenoptera	3 species.

At this point in the work a considerable difficulty was encountered in the refusal of the adult *Metadrepana* to mate in captivity. Only one mating was obtained and since the caterpillars had disappeared in the field owing to vigorous spraying campaigns there was a large gap in the supply of caterpillars. As a result of this, efforts to breed the parasites failed, and very considerable delay was entailed in further experiments. It was considered necessary to investigate the life-history and bionomics of *Metadrepana* fully, and to solve the technical difficulties of breeding it before parasite work could be continued with any success. At the moment it is still uncertain what is the cause of this refusal to mate, but it is probably necessary both to expose the pupæ to sunlight for a number of days, and to allow the adults considerable room in which to mate. It is hoped that experiments on the present generation of caterpillars may solve the problem.

When this problem is solved it is hoped to be able to breed a stock of *Metadrepana* in such a way as to have all stages present at any time, when parasite work may be taken up again, with more hope of success.

F. B. NOTLEY.

The Insectaries Manager, who was in charge of the work of breeding ladybirds for distribution to coffee estates, reports :—

It is with regret that I have to report the partial failure of the imported species of ladybird, *Cryptolæmus montrouzieri*, Muls., as a satisfactory predator on the common coffee mealy bug, *Pseudococcus lilacinus*, Ckll.

This is due chiefly to the fact that, whether because of the climatic conditions, of for other reasons, *Cryptolæmus* has definitely failed to become established on plantations, and a heavy liberation of predators each year at the beginning of the active breeding phase of *Pseudococcus lilacinus* would thus be necessary. Unfortunately, this heavy liberation is almost impossible under our conditions.

Coffee is not a crop which lends itself readily to mealybug collection (for food for the ladybird) and this limits, to a very small quantity, the supply of mealy bug for potato sprout infestation and for supplementary food. Hence only a limited number of predators can be reared in any one year and unfortunately this number is nowhere near providing for an effective control.

During the year experiments were carried out with the breeding of several indigenous species and of these the most satisfactory would appear to be *Scymnus guttulatus*, Sicard, and *Scymnus ancoralis*, Sicard. During the latter part of the year considerable attention was given to these two species and numbers were distributed to plantations.

It is unfortunate that the present banding methods with sticky preparations, as a preventative of ants attending mealybug, is somewhat detrimental to the effectiveness of control by ladybirds.

It is noted that *Scymnus* species try to obtain cover when about to pupate and crawl down the stem into crevices, etc. With a sticky band the inevitable result is they get caught and eventually die. I myself counted 347 dead larvæ on one band. It is suggested as a control measure to this and to conserve the utmost benefits from predators that a rough band of hessian or other material should be tied lightly above the sticky band.

Nine tons of potatoes were used during the year and 100,000 adult ladybirds were distributed to plantations.

T. L. McCLELLAND.

DR. JAMES'S REPORT.

I returned from leave in May and, after a brief period on locust destruction, work was continued on several aspects of the mealy bug problem.

The investigation may be considered under three headings :—

(1) An exploration of the possibilities of improving biological control.

(2) Ant control.

(3) Further research on the bionomics of *P. lilacinus*, with special reference to the status of the male in the economy of the species.

(1) *Biological Control.*

It should be clearly understood that the exclusion of ants from coffee trees is a form of biological control and that the heading "ant control" is only used for convenience of narration.

The elimination of ants from the foliage of coffee trees results in the conservation of the indigenous predators and thus accelerates the disappearance of infestations. Hence the introduction of more efficient predatory and parasitic agents of control is an obvious desideratum.

It may be attempted in two ways :—

(*a*) By the introduction of the specific enemies of *P. lilacinus.*

(*b*) By the importation of as many species of *polyphagous* mealy bug predators and parasites as are obtainable in the hope that the ecological conditions here will prove exceedingly favourable to one or more of them.

Incidentally it should be remembered in connexion with the introduction of predators and parasites that the primary objective is to bring about an economic reduction in the abundance of the pest concerned. If, for example, introductions are attempted with five species of parasites and only one succeeds in establishing itself, and it brings about a useful degree of control, the experiment has been successful. It would be wide of the mark to assert there had been four failures since the objective was pest control, and once this is achieved it matters little as to what becomes of the ineffective parasites.

With regard to the question of the introduction of specific enemies of the coffee mealy bug, it was necessary first to make certain of the specific identity of the pest and secondly of its exotic status in the Colony.

Microscopic preparations of the common Kenya mealy bug have been compared with type specimens of *P. lilacinus* from the Phillippines, Java, Ceylon, and South India. The resemblance is extraordinarily close and there would be no reason to doubt that it actually was that species except for the fact that *lilacinus* is considered to be viviparous, that is to say, the eggs hatch within the body of the mother.

The writer has carefully attended to this matter in the case of the common mealy bug of Kenya and has found that although the period of external incubation is relatively very short compared with *P. citri*, Risso, and *P. perniciosus*, Newst., it is undoubtedly oviparous. The act of oviposition has been witnessed and the resulting eggs hatched thirty-seven hours after deposition.

It seems probable that climatic and other environmental factors are capable of altering greatly the duration of the egg stage among the Coccidæ. It is noteworthy in this connexion that green scale (*Coccus viridipes*, Green) which is viviparous in Asia has an egg stage of about eleven days (Breuning) in Cuba where it has recently been introduced. After a careful study of the matter, the writer considers there is little room for doubt that the common coffee mealy bug of Kenya is *Pseudococcus lilacinus*, Ckll.

With regard to the exotic status of *P. lilacinus*, the writer has accumulated what he considers to be overwhelming evidence that it is a comparatively recent introduction.

The original epidemic which began about 1923 was intensely local in its distribution and since then the pest has spread gradually into contiguous areas, its general progress always being most rapid in the direction of the prevailing wind. It is difficult to reconcile this mode of spread with the assumption that the pest was originally widely distributed among the indigenous flora. Moreover, in certain districts where epidemics of *P. lilacinus* have only recently been recorded, the writer identified *Pheidole punctulata*, Mayr. (the mealy bug ant) two years before the common mealy bug appeared. Even at the time of writing (March, 1932) *P. lilacinus* has been recorded only from coffee plantations in the Nairobi–Fort Hall area which, faunistically considered, is very small.

Such a dominant and flourishing species of mealy bug would long ago have increased its range far beyond its present boundaries had it been indigenous.

It is also noteworthy that in those districts where the pest has been established for some years the indigenous flora is often heavily infested. On the other hand in districts where plantations have only recently been infested, the adjoining indigenous flora is quite free. The inference is, of course, that the pest has been introduced by some agency direct from an infested district and that the wild plants are not responsible for the outbreak.

There is also some evidence that *lilacinus* is increasing its range of hosts in the Colony. It has now been officially recorded from over eighty host plants in Kenya alone and recent additions to the list include such important economic plants as sugar cane, oranges, and tomatoes. Even when due allowance is made for the fact that some of these hosts may have been overlooked by earlier workers, it appears to be quite conclusive that there has been a rapid widening of host range within a comparatively short time.

This fact provides further evidence of the exotic status of *P. lilacinus* since the latter obviously is in a state of disequilibrium even in those district where it has been longest known.

No evidence has been obtained in support of the view that there are various strains or biological races of the common coffee mealy bug, each of which has a restricted host range. Proof of the existence of such strains on indigenous host plants would provide strong evidence that the species had been long established in the Colony.

The presence of such strains was believed to occur on *Combretum splendens*, Engler, (Kik. Murema) and on a spcies of hibiscus (*H. gossypinus*). The writer has tested *lilacinus* from *C. splendens*, Engl., on coffee (*C. arabica*) on three occasions and each time the mealy bugs fed and bred normally.

It should also be stated that two other species of mealy bug have been collected from this host and it is conceivable that one of them may have been mistaken for *lilacinus*. Unfortunately, specimens of *Hibiscus gossypinus* infested with *lilacinus* have not yet come under observation. The coffee feeding strain, however, feeds on *H. sinensis* and *H. aponcurus* in addition to *H. gossypinus*.

Considering the high prevalence of the coffee mealy bug, the incidence of internal parasitism is about negligible and it is very probable that the species of parasites obtained to date are forced ovipositions of females unable to find their favourite hosts.

The most effective enemies of the coffee mealybug are polyphagous predators, that is to say, they prey on other species of insects in addition to *lilacinus*. The absence of specific enemies is additional proof of the exotic status of *P. lilacinus*.

Immediately prior to the war, fairly extensive collections of scale insects and mealy bugs were made over a considerable extent of what is now the *lilacinus* area of Kenya.

These collections were sent to the Imperial Institute of Entomology, London, and although all the specimens have been recently re-examined none of them was found to be *lilacinus*.

Anyone who has examined the flora of undeveloped land in districts where *lilacinus* has been established for some years, will realize the utter impossibility of its presence being overlooked.

Hence all the available evidence tends to show that the common coffee mealy bug was introduced into the Colony some time soon after the war when a great expansion of the settled area was taking place and many exotic plants were being brought into the country.

It would be interesting and perhaps important to know from what part of the world the infestation came so that the feasibility of introducing its parasites from that locality might be specially examined. However, the possibility of obtaining evidence of this character is now remote.

There are several countries in which *lilacinus* occurs, e.g. Ceylon and South India, which are in fairly constant steamship communication with Mombasa. Moreover, the possibility of its introduction from Uganda (where *P. lilacinus* is alleged to occur) must not be overlooked.

Now, the adoption of the classical method of introducing the specific enemies of an imported pest is hindered in the case of *lilacinus* owing to the almost complete lack of biological information about the species in other parts of the world. It has never been of sufficient importance elsewhere in the world to make the collection and identification of its parasites worth while. This fact alone is not without significance.

Nevertheless, despite the handicap of lack of biological information, the Agricultural Departments of Uganda and the Philippines are being communicated with in the hope of securing some result.

Comparative studies of the species of mealy bug occurring on coffee in Kenya discloses the fact that those which are only classifiable as minor pests have significant incidences of internal parasitism. In the case of both *P. citri* and *P. perniciosus* breeding experiments broke down and had to be renewed owing to the prevalence of parasites. Unfortunately, these parasites are specific and will not attack *P. lilacinus*.

The second line of action which is worth while is the introduction of polyphagous mealy bug predators and parasites.

It may be argued that there are many indigenous species of mealy bug predators so why go to the trouble of bringing in new ones.

The principle underlying the proposal to import polyphagous predators is that not infrequently introduced species of plants or animals flourish exceedingly in their new environment (as *lilacinus* has done) and become much more numerous than indigenous species of the same genus or allied genera.

Hence the expectation would be that if a series of polyphagous mealy bug predators are introduced one or more of them might acquire a high prevalence under the conditions obtaining here.

The *modus operandi* would be that say every three months or at shorter periods if possible a new species of predator or parasite would be introduced into the Colony and tried out in the chief bio-climatic areas of the *lilacinus* zone.

It should be remembered in connexion with the introduction of polphagous mealy bug predators that so far only one species (*Cryptolœmus*) has received trial.

The Superintendent of Farnham House Parasite Laboratory (Imperial Institute of Entomology) has agreed to forward consignments of all the natural enemies of mealy-bugs which are likely to be of use against *P. lilacinus*.

(2) ANT CONTROL.

The problem of repelling ants from crop trees has engaged the attention of entomologists in several parts of the world for many years.

Where eradication of the ants by trapping or poisoning has not been found feasible, control has usually been secured by the application of repellent bands to the trees.

The types of repellent bands which have been suggested and invented are many and various but the final result has generally taken the form of tanglefoot grease, applied on burlap or paraffin wax.

The special difficulty associated with the control of mealy-bug ants in Kenya is the relatively large number of trees per acre which require protection. Hence the difficulty and expense of keeping an acre of coffee ant-free are much greater than for a corresponding area of citrus or apple.

The great desideratum for more effective ant control in coffee plantations is the discovery of a repellent which can be poured or sprinkled with safety round the bases of trees thus eliminating the troublesome and expensive banding process.

With the latter object in view, attention has been paid to the possibility of securing a type of green crop which would render the area over which it is grown obnoxious to ants. Buckwheat is held by some planters to possess merits of this character but I have never been able to obtain conclusive evidence to this effect. An experiment conducted with this object in view produced negative results.

The simplification and cheapening of the banding process and the improvement of the repellents at present in use seems to offer the most practicable way of increasing the efficiency of ant control.

There are three principal types of repellents now in common use :—

(1) High boiling point tar oils : kresotow.
(2) Castor oil with or without the admixture of a proportion of resin.
(3) Proprietary banding greases.

Kresotow.—The merit of good kresotow is that it gives the highest percentage of efficient bands over the longest periods. An investigation has been conducted from the biological point of view into the differences between kresotows which behave satisfactorily in the field and those which do not.

Kresotows of both types are extremely repugnant to ants and are powerful contact insecticides.

A mealy bug ant which comes into only very slight contact with kresotow of any kind is doomed. Although the unfortunate individual may clean itself vigorously and for a short time seem to have recovered, death usually supervenes in from one to two hours after a long period of partial paralysis.

The outcome of numerous tests showed that all kinds of kresotow have a very destructive effect on the sensory structures of ants.

The above facts seem to demonstrate conclusively that the lethal and repellent powers of kresotow do not vary from sample to sample. What varies is the amount of certain compounds which cause rapid drying out of the repellent under field conditions.

Castor Oil.—The possibilities of castor oil as an ant repellent are being thoroughly explored. Castor oil does not appear to have a well defined boiling point but begins to decompose at a high temperature.

This is an important physical characteristic for a liquid repellent which has to withstand the drying effect of field conditions for many weeks.

All grades of castor oil have strong repelling powers and the fact that they are not nearly so poisonous to ants as kresotow is not very important from a practical point of view.

Ants which are smeared with the crude oil recover just as readily as those brought into contact with the more refined grades. After cleaning themselves, they appear to be completely restored to the normal in about thirty minutes. Ants suspended in castor oil of any grade die in less than a minute with the mandibles widely distended. Death is not due to asphyxiation (drowning) since a mealy-bug ant can live for many minutes just beneath the surface film of water and for several hours on it.

It is interesting to note in this connexion that the small worker of the mealy bug ant is incapable unaided of breaking through the surface film of water when once it has been submerged.

The above tests suggest that castor oil is a violent stomach poison and that the lethal qualities of the more refined quality are not appreciably less than those of the crude oil. Castor oil is obtainable commercially in three qualities.

The investigation of castor oil repellents is proceeding along the following lines :—

(*a*) The determination of the duration in the field of the repellent powers of the different grades of castor oil.

(*b*) Whether the admixture of a proportion of resin will prolong the duration of their effectiveness and, if it does, what is the best proportion to use. Also whether the addition of an ant poison, e.g. mercuric chloride, to a castor oil repellent has any value.

(*c*) The evolution of a band suitable for castor oil repellents.

Banding trials are now being conducted with all grades of castor oil. The crude oil starts with an advantage owing to its cheapness and unless the more refined grades show an unexpectedly longer period of effectiveness in the field, it will be recommended in preference to them.

Where supplies of castor seeds can be obtained, it will undoubtedly pay to employ native labour to express the oil.

The value of admixtures of different proportions of resin are also being tested.

Those who desire immediately a recipe for a castor oil repellent may use a mixture composed of 70 per cent castor oil and 30 per cent resin. This has now remained effective for nearly eight weeks in the Makuyu district.

It should be pointed out that crude castor oil will not dissolve the impure resinous exudates from *Grevillea* nor probably those from most other resiniferous trees which occur in the Colony.

Banding trials with castor oil-resin preparations containing different proportions of mercuric chloride showed that this poison did not add to their effectiveness. In fact, bands containing the higher percentage of the poison broke down first.

With regard to the type of band most suitable for castor oil repellents, it was early observed that cellophane in place of grease proof paper was much to be preferred. Where grease proof paper is used one of the principal causes of loss is the absorption of the oil by the paper.

The use of cellophane entirely eliminates this source of loss and also excludes the possibility of the oil coming into contact with the tree beneath the band.

During the effective life of a castor oil band, there is a gradual gravitation of the oil to the lower edge of the band with consequent loss by dripping.

It is possible that the trials now being conducted will show that the admixture of a certain proportion of resin by increasing the viscosity of the oil will retard this process without otherwise reducing the duration of effectiveness.

However, whenever a castor oil repellent is employed, the lower edge of the cloth should be doubled up by half-an-inch to assist the latter to " hold " the oil.

The width of the cloth should be at least three inches and it is very important that the band should be saturated with the repellent up to the dripping point.

Tests of the relative " holding " powers of different fabrics for the oil have been made. A very coarse textured cloth such as Hessian dries out quickest. It is also noteworthy that the better quality " americani " (cotton cloth) is not so good in this respect as the cheaper grades.

Hessian cloth used as a substitute for cotton wool is effective on a number of trees where tests are being carried out.

More extensive trials are still necessary, however, before a recommendation can be made. Blanketing material has been found by certain planters to be an effective and cheap substitute for cotton wool.

It is very important to remember that whatever material is used to obtain close contact, the bark should always be thoroughly rubbed with sacking at the point where it is intended to place the band. Premature breakdowns commonly occur owing to the ommission of this important detail.

Banding trials are also being conducted with a variety of substances, e.g. mineral and lubricating oils, pyridine, phenol, etc., and one of these substances may ultimately prove to be of importance.

The application of proprietary banding greases direct on the bark is becoming very widespread despite the fact that this method is not recommended by the Department. A few complaints have been received that trees have been injured by the grease but these have come mainly from districts where coffee is grown on the multiple stem system and the grease has to be applied to fairly young wood.

However, conclusive proof has by no means been obtained that the prolonged application of grease direct on the bark of mature trees will be harmless.

It is reported from South Africa that tanglefoot grease applied on paraffin wax has been successfully used in citrus orchards.

Tests with paraffin wax of M.P. 112 degrees Fahr. showed that it failed to retain its shape in the heat of day and breakdowns rapidly occurred. Moreover, the practical difficulties of applying wax to the much larger number of trees per acre in coffee plantations appear to be very great.

The suggestions of two planters from the Donyo Sabuk district are being examined. One proposal is that the banding grease should be applied on a coating of bituminous paint. Its application to insulating tape is now being tried out.

Finally it should be particularly noted that all grades of castor oil are injurious to trees. So-called " home-made " greases of which castor oil forms one of the components should not be applied direct on the bark. It is certain to have immediate harmful results.

(3) *The Status of the Male in the Economy of P. lilacinus.*

Further information has been sought concerning the life cycle and habits of *P. lilacinus* with a view to breaking the life cycle or otherwise facilitating control.

Special attentian has been paid to the status of the male in the economy of the species. Numerous breeding experiments show conclusively that the peculiar habit of the male of *P. lilacinus* in migrating to the base of the tree or even into the soil for " pupation " is largely due to the effect of light.

When reared under completely shaded conditions in the laboratory, the male does not exhibit this phenomenon to so marked an extent.

The fact that in the unshaded conditions of most coffee plantations in the mealy bug area the males seek the bases of the trees and the soil for their final transformations offers scope for practical treatment.

In the first place it is necessary to know what part the males play in the reproductive cycle of this species of mealy-bug.

It should be realized that practically nothing is known about the functions of male mealy bug in general and that up to about 1922 all species were considered to be parthenogenetic owing to the fact that male mealy bugs were rarely observed. This belief was maintained until Schrader, after a careful series of experiments, proved that *P. citri*, the common greenhouse mealy bug of Europe, was strictly non-parthenogenetic.

Since then, Hough has proved that *P. comstocki*, the common mealy bug of the Far East, is non-parthenogenetic. It was decided therefore to ascertain the following facts about the common coffee mealy bug of Kenya :—

(*a*) Does parthenogenesis occur?

(*b*) If parthenogenesis occurs, to what extent, if at all, is the male necessary for reproduction?

To ascertain whether parthenogenesis occurs, a large number of females of *P. lilacinus* were reared from egg to adult enclosed in petri dishes under conditions which excluded the possibility of access to the male.

The females were kept continuously supplied with fresh coffee leaves and under the artificial conditions of the experiment the life cycle was considerably prolonged.

Despite their unusual environment, however, virgin females showed themselves capable of ovipositing eggs which proved to be fertile. It now remains to be ascertained whether the male is entirely unnecessary for the continued vigour and fertility of the species.

H. C. JAMES.

Appendix II

BOTANICAL SECTION

Annual Report, 1931.

BY THE SENIOR MYCOLOGIST AND STAFF.

STAFF.

Mr. J. McDonald, Senior Mycologist.

Mr. C. A. Thorold, Mycologist.

Mr. D. C. Edwards, Agricultural Officer in charge of Grassland Improvement and Plant Introduction.

Mr. F. W. Evans, Junior Laboratory Assistant. Absent on leave from 4th July onwards.

Mr. Thorold continued his work at the Coast until the end of April. During this period he was principally engaged on coco-nut disease investigations. With the advent of the planting season in the highlands he was transferred to Njoro in May in order to take up general mycological duties in that area and in particular to co-operate with the Plant Breeding Section in pathological investigations bearing on the work of that section. Mr. Thorold has now relieved me of all cereal disease work except that on wheat stem rust which I have retained in view of the fact that it has been a personal study for some years.

My own time has been chiefly taken up with advisory and administrative duties, investigations on coffee diseases, wheat stem rust and various diseases affecting minor crops.

In this report I have incorporated extracts from Mr. Thorold's account of his principal lines of investigation during 1931. Mr. Edwards' report on his work on grassland improvement and plant introduction is forwarded separately.

Travelling.—Mr. Thorold and myself: 5,200 miles approximately.

Correspondence.—781 inward and 804 outward letters, dealt with at Nairobi, included 177 reports on disease in forty-two different host plants and thirty-one identifications of botanical specimens received.

PUBLICATIONS.

Thirteen bulletins and articles (*see* general list).

INVESTIGATIONAL WORK.

Coffee.

In continuation of the three years' observational experiment on the effect of lime and fertilizer applications on the incidence of coffee berry disease at certain farms in Kericho and Sotik, second applications of phosphates and potash were made in February. A slight modification was introduced by applying dressings of these fertilizers on one of the plots which received lime in the previous season at each of two of the farms where the experiments are in progress. Inspection of the plots in August failed to reveal any marked improvement in the treated plots compared with the controls.

With the arrival of Mr. Gethin Jones, Soil Chemist, more direct co-operation on the chemical side of the coffee berry disease problem has become possible. A Plant Inspector (Mr. H. R. H. Stone) has now been stationed permanently in Sotik to carry out and make detailed observations on a series of experiments designed by a small team of officers comprising the Senior Coffee Officer, the Soil Chemist and myself. The experiments in hand cover a wide range and include cultural, nutritional and fungicidal treatments.

In August, on the invitation of the Department, Dr. H. H. Storey, Plant Pathologist at Amani, who was passing through Kenya, broke his journey to join Mr. Gethin Jones and myself in Sotik, to examine and discuss the coffee berry disease situation. Dr. Storey expressed himself as impressed with the complicated nature of the factors which contribute to the severity or otherwise of the disease and, while agreeing in general with the methods of investigation employed in the past, stressed the possibilities of vegetative propagation from bushes showing resistance to the disease. The thanks of the Department are due to Dr. Storey for making the visit at no little inconvenience to himself, and for his subsequent report.

In the laboratory cultural work has been carried out on various strains of *Colletotrichum coffeanum* which attack coffee berries. These strains have included those which cause coffee berry disease, brown blight and scab. The last is the name which I have given to a small buff-coloured spot frequently seen on green coffee berries, not only in coffee berry disease districts but also sometimes elsewhere. Scab appears to be an extremely superficial spot affecting small portions of the pulp only and of little intrinsic importance. The object of the cultural studies on the strains causing the three diseases has been to obtain mutation (saltation) from one to the other, since the view is commonly held among planters that brown blight gives rise to berry disease. In the laboratory mutations have been obtained in cultures of all three strains but in no case has the brown blight or scab strain given rise to that causing berry disease.

The condition in which decayed beans are found inside apparently sound cherry has been reported in Kenya for some years and its connexion with antestia infestation has long been suspected. In 1929, Dr. Wallace, Mycologist in Tanganyika Territory, isolated the fungus *Nematospora coryli*, Pegl. from such beans and succeeded in proving that it is carried by antestia. During 1931 antestia was prevalent in several districts in Kenya and the presence of decayed coffee beans in externally sound cherry was commonly associated with such bug infestations. The opportunity was therefore taken to make a special search for the fungus. As a result, *Nematospora coryli* was found in every one of sixteen decayed beans derived from berries taken from bushes known to have been severely attacked by antestia in Kipkarren district. The same fungus was also commonly found in specimens obtained under similar circumstances from Nairobi and Songhor districts. It belongs to a small group of species which attack seeds only and which are associated with attack by certain insects. Dr. Wallace has named the disease "coffee bean disease" and, in order to avoid complication, it is proposed to adopt the same name in Kenya, although in this country there is admittedly some danger of confusion with the totally different disease bearing the somewhat similar name of "coffee berry disease." *Nematospora coryli* is unable to reach the coffee bean without the aid of the insect but once it has gained access in this manner it is liable greatly to increase the damage directly due to the bug. By a coincidence, *Nematospora gossypii*, Ashby and Nowell, one of the fungi causing internal boll disease of cotton, was obtained for the first time in the same month from cotton bolls collected at Taveta. In the case of this disease, the fungus is introduced into the interior of the bolls through the agency of stainer bugs.

Wheat.

In continuation of the work of previous years, the search for new physiologic forms of stem rust was maintained and as a result a new form was found to be present in samples collected at Ulu in June and at Nairobi in August. Four different physiologic forms of wheat stem rust are now known to occur in Kenya. Both Kenya Governor and Kenya Standard wheat varieties are susceptible to the new form, K4, under conditions favourable to infection.

Mr. Thorold reports as follows on wheat diseases which he has had under investigation at Njoro in the second half of the year :—

" Black chaff disease seems to occur in many districts, and as it is important that its presence in a crop should be realized, the symptoms are briefly given.

The stalks are brown or black striped, the glumes (chaff) are also marked with parallel stripes, often more numerous and conspicuous towards the tips; ultimately these stripes may coalesce into patches, which latter are never circular in outline and always appear smooth. The grain is shrivelled and the surface may be covered with minute bacterial cavities which give the grain a characteristic appearance. An infected crop may result from planting such shrivelled seed with the cavities containing the organism causing the disease. Experiments are being conducted on the control of the disease by seed treatment, and to find out if infection from the soil occurs also.

" Take-all " disease has been found to be rather prevalent at the higher altitudes (over 8,000 feet) and where the land has been under wheat for many years.

The general effect on the crop is similar to that of the more widespread root disease (see below). Take-all typically occurs in patches in the field, and there the plants are bleached and stunted, and usually only produce barren ears, depending on the time of infection. The appearance of individual plants is very characteristic. The base appears blackened, and the roots are black and woolly, owing to a dense formation of root hairs; a second lot of roots may be formed higher up and also become infected. On peeling the lower leaf sheaths from the stem, there is found a black felt or shiny plate of mycelium surrounding the stem.

The fungus (*Ophiobolus graminis*) persists in the soil on grasses and cereals, but cannot remain alive for long in absence of these hosts. Although experiments have not yet been carried out to this effect in Kenya, the experience of other countries suggests that oats are little affected by the disease, and barley is liable to be slightly damaged. Where take-all is present in a field it would be best to avoid a cereal crop for at least a year, and the land should be kept as free as possible from " couch " and other grasses.

Root diseases.—In continuation of work commenced by Mr. Maher on root rots of wheat, cultural work has been carried out on wheat from different farms, representing varying temperatures and soils, to find out the extent and variety of fungi infecting wheat. Particular attention has been paid to those fungi common to both wheat and maize, because of the obvious importance in the crop rotation. There is great variety, in both species and strains, of fungi associated with root disease, but all those that are being considered in this connexion are weakly parasitic, or facultative parasites. The worst effect of root disease can be eliminated by good agricultural practice and aiming at the best growth of the crop from germination, as previously recommended by H. J. Taylor and Colin Maher (*Root Rot*, *Foot Rot* and *Head Blight of Wheat in Kenya*, Bulletin No. 4, 1931). The farmer will always be to some extent at the mercy of exceptional seasonal conditions, and good healthy seed will not always be available from his own crop. Owing to the fact that seed is often internally infected, treatment with fungicide dusts cannot be relied upon to give much control.

Observations are being made on fungi associated with scab and discoloured and shrivelled grain.

Glume blotch has not yet been investigated to any extent, since other diseases (as above) appear to be of much greater importance in directly affecting yield and quality of grain, and have more urgently required investigation.

Investigations in Canada have shown that resistance to rust infection may in some cases be due to the time during which the stomata of the wheat plant are open. A period of opening which is unfavourable for infection may confer a degree of " functional " resistance to stem rust. A few observations were made at the Plant Breeding Station, with a view to finding out if certain varieties and hybrids showed this type of resistance, and also to make trials of a technique of stomatal measurement for more extensive observations in the future."

In the Annual Report for 1930 the discovery of the cluster-cup stage of a rust on indigenous barberry (now named at Kew as *Berberis Holstii*, Engl.) was reported and its possible connexion with stem rust of wheat was mentioned. A considerable study of the subject has been conducted during the year and attempts have been made to transfer the barberry rust to wheat, and wheat stem rust to barberry. In the former inoculations, an occasional pustule has appeared on certain varieties of wheat but no infection comparable with that obtainable from wheat to wheat inoculations has occurred. In the opposite direction no success whatever has been obtained, presumably because it has not so far proved possible to obtain germination of teleutospores from wheat stems. Infection of barberries from wheat can only be obtained through the agency of this type of spore which is produced late in the season in the black pustules to be seen on mature or nearly mature wheat straw. In temperate climates these teleutospores germinate only in spring, after exposure to winter conditions, and it is the general experience in tropical countries that they do not germinate in nature. It was thought, however, that on wheat straw grown at 9,500 feet at Mau Narok and left exposed to the mild frosts which are fairly frequently experienced there, teleutospores capable of germination might be obtainable. Several germination tests with such spores have, however, invariably given negative results.

Rust infection on the indigenous barberry produces a witch-broom effect which is not recorded for infection with wheat stem rust on species of barberry in other countries. The arrangement of the rust pustules on the leaves of the indigenous barberry also shows marked difference from that produced by the wheat rust elsewhere although the anatomy of the individual pustules is fairly similar in each case.

Taking all observations and experiments into consideration it may be said that, while absolute proof is lacking, it is unlikely that the rust on indigenous barberry in Kenya is in any way connected with stem rust of wheat. In December a second spore form (uredospore) was found on barberries at 10,200 feet at Mau Narok in association with the cluster cup stage. If these two forms can be shown to be different stages of the same rust, further evidence will be afforded that the barberry rust is not connected with that on wheat since in other countries no uredospore stage on barberries is known in connexion with the alternate stage of wheat stem rust.

Maize.

In the early part of the year, considerable cultural work was carried out in isolating the fungi associated with various types of root, stalk and ear rots submitted by the Agricultural Officer, Kitale. The main object of this work was to enable definite symptoms encountered in the course of maize breeding work to be linked up with the presence of particular parasites. One of the commonest fungi found to occur in these rots has now been identified authoritatively through the assistance of Dr. Doidge of Pretoria as *Fusarium moniliforme*, Sheld., var. *conglutinans*, Wr. and Rkg., a fungus well known in other parts of the world.

Since he was posted to Njoro, investigations on maize diseases have been handed over to Mr. Thorold, who reports as follows :—

"The importance and extent of losses due to ear rots and root rots of maize have been already emphasized (Colin Maher, *Ear Rots and Root Rots of Maize in Kenya, and some Suggestions for their Control*, Bulletin No. 5 of 1931), and further studies in the laboratory, by the present writer have shown that many strains, and possibly several species of *Fusarium*, are associated with these maize diseases. Many observations were made on farms and experimental plots at Kitale and elewhere, to find out under what conditions these diseases varied in severity, whilst experiments have been carried out, employing different soil and temperature conditions, to investigate the conditions under which maize seedlings show different susceptibilites to infection. Further, by experimenting with the effect of mineral fertilizers in regard to soil infection, it is hoped to obtain information which will be of value to the farmer in tackling these maize diseases, until such time as resistant varieties are available. Maize seed is so often internally infected with ear-rot and other fungi, that the benefit to be derived from fungicide dusting is considerably reduced."

Sisal.

Two minor investigations were carried out in connexion with this host. In March specimens of sixteen-months'-old plants which showed shrinking and blue discolouration of the leaf bases were received from Voi. A fungus, since identified at the Imperial Mycological Institute as *Pythium aphanidermatum* (Eds.) Fitzpat., was readily isolated from the diseased tissues but attempts to cause infection by inoculating young sisal plants at the laboratories failed. The affected plants at Voi had been subjected to conditions of poor drainage during a period of exceptionally heavy rain in the previous year and this had doubtless rendered them susceptible to attack.

A somewhat similar rot of the leaf bases, sometimes extending into the bole, was investigated by Mr. Thorold at Gazi. Various fungi of no particular parasitic reputation were isolated from the diseased plants and the trouble was found to be associated with the presence of a hard pan near the surface of the soil.

Coco-nut.

In the earlier part of the year, Mr. Thorold continued his investigations on coco-nut diseases. The following is his summary of this work, a fuller account of which was published in the local press some months ago :—

"Whilst stationed at Mombasa various coco-nut diseases were investigated, particularly those referred to as "gumming" and "nut shedding." Malformations of nuts, such as occur in gumming, and the shedding of young nuts, were found to be physiological diseases, gumming probably being due to soil deficiencies, and shedding associated with particular conditions of soil moisture. These diseases occur in most of the main coco-nut areas of the Coast.

Nut shedding in some months is serious, and causes great loss of potential crop. It was found from statistical examination of the crops from five estates over five years, that crop and rainfall are correlated, so that a month of low rainfall leads to a much reduced crop some months later, owing to the shedding of immature nuts during a dry period. This indicates the necessity of conserving soil moisture during periods of drought and low rainfall. Cover crops and green-manuring are recommended as means of maintaining better moisture conditions in the soil.

Bud-rot is fairly widespread on the Coast. On many estates it occurs occasionally, whilst in some localities, as at Gazi and Ganda (near Malindi), this disease is endemic and causes the loss of many palms every year. It is very important that a palm should be cut down and the top burnt whenever the first symptoms are seen, since recovery from true bud-rot seldom, if ever, occurs."

Barley.

Two further experiments were begun, one at Nairobi and one (by the Agricultural Officer, Mr. Spranger) at Njoro, to test the efficacy of various fungicides in the control of covered smut of barley (*Ustilago hordei* (Pers.) K. and S.). The experiment at Nairobi was unfortunately completely destroyed by locusts but, in that at Njoro, complete control was obtained by seed treatment wtih a proprietary dust, "Ceresan," and also by the formalin method. A plot from seed treated with Tillantin R dust contained 0.35 per cent of smutted heads while the untreated control plot showed 0.38 per cent infection. The seed used was artificially infected with smut spores but the degree of infection was made more nearly comparable with that of normal farm seed than that employed in the unsuccessful experiment recorded in the Annual Report of 1930. The result at Njoro in 1931 confirmed that from the experiment with normally infected farm seed in 1930 when, however, the control showed a much higher percentage infection, doubtless due to the existence of seasonal conditions more favourable to the fungus.

Potato.

It is probably known to many growers that, owing to the tendency of potatoes grown in Southern England to " degenerate " it is the custom to make periodic introductions of new " seed " from Scotland, where the trouble is less marked. So-called " degeneration " is now known to be due to virus diseases, several types of which exist in Kenya.

It occurred to me that it would be of interest and possibly of considerable value to conduct an experiment to discover whether conditions exist at the higher altitudes in this country which would enable potatoes to be maintained in virus-free or nearly virus-free condition. Early in the year, therefore, through the courtesy of the Director, Dr. R. N. Salaman, small quantities of virus-free tubers of certain potato varieties were obtained from the Potato Virus Research Institute, Cambridge, and were grown in isolated plots in a field of wheat at an altitude of 8,500 feet at Mau Summit. Plants were subsequently raised in a muslin cage at Nairobi from small random samples taken from the Mau Summit crop and these appeared to have maintained their freedom from virus. The remainder of the crop grown at Mau Summit in 1931 will be used for purposes of observation and multiplication in 1932. Grateful acknowledgement must be made to Messrs. Hemphill and Barker of Mau Summit for their assistance in growing the crop and to Dr. Le Pelley of the Entomological Section for very readily giving me the benefit of his special knowledge of potato virus diseases.

Beans.

Mr. Thorold has included some investigations on diseases of beans, especially bacterial blight, in his work. The following is taken from his report on this subject :—

" Investigation has shown that it is probably the same organism that is responsible for the bacterial blight affecting leaves and pods of *Phaseolus vulgaris*, vars., cowpea and Njahi (*Dolichos lablab*). The bacteria are carried internally in the seed. The spread of disease in the crop is favoured by cloudy and wet weather. In the wetter districts, trials will be necessary to find out the best time for planting, so that the beans make most of their growth after the wettest months. It is essential to plant " plump " seed, and not such as shows the surface blistering and discolouration caused by the bacteria of this disease. It is possible that resistant varieties may be found."

Locusts.

During the height of the locust invasion (*Locusta migratoria migratorioides*, R. and F.) considerable mortality occurred in certain of the wetter districts due to attack by a fungus, which was identified at the laboratories as *Empusa grylli*, Fresn.

Mr. Thorold spent some time in attempts at growing the fungus artificially with a view to its dissemination amongst swarms not already affected but met with no greater success in this direction than previous investigators in other countries. He also tried to infect healthy locusts by contact with diseased specimens, by contaminating their food with the fungus and by other methods but was equally unsuccessful in these attempts. He concludes that: "The fungus is probably an obligate parasite, and there is little hope of being able to grow it apart from its host. There are probably certain conditions of temperature and humidity necessary for successful inoculation of locusts." A summary of his investigations was published in Bulletin No. 21 of 1931, entitled "Report on the 1931 Locust Invasion of Kenya."

Groundnut.

An investigation of a destructive wilt disease of this crop at the Coast was begun in the latter half of the year. Certain fungi were isolated from diseased specimens and inoculation work was started with these organisms. The disease, however, had not been successfully reproduced by this means at the end of the year.

ADMINISTRATION.

Sugar Cane.

The prohibition of the growing of any variety of sugar cane other than Uba, which had been in force for three years in Kisumu–Londiani district on account of the presence of mosaic disease, was allowed to lapse from June 1st. At the same time in this district growers were advised for the present to restrict their plantings of new canes to the highly resistant P.O.J. canes and, as an encouragement to do so, applications were invited for a free issue of small amounts of P.O.J. 2725 and 2727 from the quarantine at the Scott Agricultural Laboratories. Eight applications were received from Kisumu–Londiani district and issues amounting to several tons of cane were made. Towards the end of the year a few stalks only of P.O.J. 2878, 2714 and 2722, were issued to one or two of the larger growers. A few setts of the mosaic-susceptible variety BH 10/12 were also issued to Messrs. Muhoroni Sugar Company, Muhoroni, in June, to be planted in their nurseries as a test of the presence or absence of mosaic. This cane was free from mosaic disease at the end of the year.

Mosaic disease was found to be present in October in a few stools of cane (variety unknown) grown by squatters along the banks of an irrigation furrow on a farm at Taveta, close to the border of Tanganyika Territory. The owners of the farm readily consented to see that the affected stools were dug out. This was done and a small quantity of setts of P.O.J. 2727 were sent from Nairobi to replace the diseased cane. This outbreak appeared to be confined to Taveta. No mosaic was found in susceptible varieties at Manoni Sugar Estate, Masongaleni, nor at Ramisi Sugar Estates on the Coast. At the latter place mosaic-like symptoms were observed in so-called Uba cane. Dr. Storey, who was present at the time, has since reported on this matter as follows :—

"The cane regarded by the company as the variety Uba, consists in part at least of a variety resembling that known in Natal as "Agaul." This variety is indistinguishable from Uba on all ordinary characters, but usually shows the leaf-markings characteristic of mosaic disease. Hitherto it has been supposed that the stock of this variety in South Africa is all affected with mosaic, but highly tolerant to this disease. There is evidence to show that the Agaul variety was brought from Natal to East Africa, and it is probable that the cane now growing at Ramisi originated from this source.

As a result of recent investigations I have come to doubt the identity of the mosaic disease in Agaul with the well-known mosaic disease of sugar cane. I have, however, as yet no definite evidence either way. The fact, however, that at Ramisi large quantities of susceptible cane varieties are growing near the Agaul, and that a careful search revealed no mosaic disease in these varieties, gives support to the suggestion that the disease is not transmissible from Agaul to other varieties."

Anti-Striga Campaign.

A camapign against the parasitic striga weed (*Striga hermonthica*, Benth.) was carried out in Nyanza Province along lines similar to those of the previous season. For the non-native area Honorary Striga Inspectors were supplied by the Songhor, Muhoroni and Koru Farmers' Associations and worked under the immediate supervision of the Plant

Inspector, Songhor (Mr. Stone till July, afterwards Mr. Knight). The Fort Ternan Farmers' Association declined to appoint an Honorary Inspector. Each Honorary Inspector was allowed to appoint a native striga scout to assist in inspection of squatter shambas. The campaign in 1931 was carried out under very great difficulties owing to the prior necessity of concentrating on the destruction of the locusts which heavily invaded the striga area on numerous occasions during the maize-growing season. The general opinion, however, was that striga weed was much less prevalent than in recent seasons and that the campaigns in 1930 and 1931 had improved the situation considerably. Arrangements are in preparation for a further campaign in 1932.

GENERAL.

In October I visited the East African Agricultural Research Station, Amani. This enabled me to gain first-hand knowledge of the resources of the station, to meet the different members of the staff and to see and discuss the various branches of scientific work in progress. In particular I went very fully into the subject of vegetative methods of propagation of coffee and brought back full notes on this (kindly supplied by the Geneticist, Mr. Doughty) for the benefit of the Senior Coffee Officer and others interested. I naturally spent much of my time at Amani with the Plant Pathologist (Dr. Storey) with whom I discussed many problems of mutual interest. I should like to take this opportunity of expressing my thanks for the courtesy and ready assistance which I received from the Director and members of the staff of the Research Station during my visit.

Two diseases of importance were recorded from new areas of the country in 1931. Coffee berry disease was found in North Lumbwa district in July and maize head smut was reported on one farm in each of Fort Ternan and Muhoroni districts in June. The latter disease had not previously been recorded outside the Rift Valley area. All Farmers' Associations from Lumbwa to the Lake were immediately notified of these outbreaks of head smut.

Specimens of apple scab were received almost simultaneously from Naivasha and Limuru districts. These are the first occasions on which this disease has been reported in Kenya.

Botanical collections were made as usual and forwarded to the Royal Botanic Gardens, Kew, for naming. These included many specimens of grasses and legumes obtained by Mr. Thorold in the Coast area, several of which were new to the herbarium.

NEW PLANT DISEASE RECORDS.

The following are new plant disease records for the year :—

Maize.—Root stalk and ear rot; *Fusarium moniliforme*, Sheld.

Wheat.—Take-all; *Ophiobolus graminis*, Sacc.

Wheat.—From root; *Helminthosporium sativum*, P.K. and B.

Coffee.—Bean disease; *Nematospora coryli*, Pegl. (associated with infestation by the coffee bug (*Antestia lineaticollis*, Stal.).

Cotton.—Internal boll disease; *Nematospora gossypii*, Ashby and Nowell, associated with infestation by stainers (*Dysdercus* sp. and *Oxycarenus* sp.).

Cotton.—Leaf mildew; *Ramularia areola*, Atk.

Sisal.—From diseased leaf bases; *Pythium aphanidermatum* (Eds.), Fitzpat.

Bean.—Bacterial blight; *Bacterium phaseoli*, E.F. Sm.?

Cassava.—Leaf spot (*Manihot utilissima*); *Cercospora henningsii*, All.

Napier Fodder.—On leaves (*Pennisetum purpureum*); *Beniowskia sphaeroidea* (K. and Cke.), Mason.

Apple.—Scab; *Venturia inaequalis* (Cke.), Wint.

Plum.—On bole of living tree; *Ganoderma lucidum* (Leyss.), Karst.

Orange.—Pink disease; *Corticium salmonicolor*, B. and Br.

Orange. On twigs.—*Septobasidium* sp. associated with presence of scale (*Lepidosaphes beckii*, Newm.).

Mango.—Leaf spot; *Gloeosporium mangiferae*, Henn.

Avocado pear (*Persea americana*).—Alga leaf spot; *Cephaleuros mycoidea*, Karst.

Raspberry.—Leaf spot; *Septoria rubi*, Wint.

Locust (*Locusta migratoria migratorioides*).—*Empusa grylli*, Fresn.

Mosaic diseases were also recorded on the following hosts :—Bean (*Phaseolus vulgaris*), green gram (*P. mungo*), black gram (*P. mungo* var *radiatus*) and cowpea (*Vigna catjang*).

In conclusion it remains to acknowledge the very valuable assistance received as usual from the directors and staffs of the Royal Botanic Gardens and the Imperial Mycological Institute respectively.

J. McDONALD.

REPORT OF THE AGRICULTURAL OFFICER IN CHARGE GRASSLAND IMPROVEMENT AND PLANT INTRODUCTION.

TRAVELLING.

Approximately 2,750 miles were covered by road during the year. Three journeys only of considerable length were made. These consisted of one to a number of farms and the Wakamba Reserve in the Machakos area, one through the Trans Nzoia area and one through the Molo area. The remainder of the travelling consisted of short journeys to Ngong and Machakos in connexion with experiments at those places, and travelling locally for the purpose of collecting planting material of herbage species.

CORRESPONDENCE.

Outward letters, 607; inward, 562.

The bulk of this correspondence was connected with requests for planting material from abroad and the distribution of this material for trial. In addition there was an increasing amount of correspondence connected with grassland matters, mainly concerned with the laying down of pastures and the manuring of grassland.

GRASSLAND IMPROVEMENT.

Isolation of Valuable Herbage Plants.—Efforts to isolate the valuable indigenous herbage species have been continued.

The work has been confined in the main to the grasses, of which some thirty common specis have been under observation. A number of introduced plants have been included in the experiments, but the main effort has always been directed towards the collection of data by which to assess the value of species believed to be valuable in the natural pastures.

Palatability.—Two further palatability experiments were carried out at the Scott Laboratories in continuance of the work started in 1930. Tests have now been made under two definitely different sets of climatic conditions—at the beginning of the rains after a prolonged dry period, and at the end of the rains. From the results of the experiments the following grasses have been shown to be palatable :—

Pennisetum sp. (17).

Themeda triandra, Forsk. (red oat grass).

Pennisetum clandestinum, Hochst. (Kikuyu grass).

Hyparrhenia rufa, Stapf.
Pennisetum sp. (2).
Cynodon plectostachyum, Pilg. (19) (star grass).
Leptochloa obtusiflora, Hochst.
Chloris gayana, Kunth. (Rhodes grass).
Paspalum dilatatum, Poir.
Panicum trichocladum, Hack.
Paspalum scrobiculatum, Stapf.
Brachiaria soluta, Stapf.
Panicum coloratum, Stapf.
Eragrostis paniciformis, A.Br.
Phalaris sp.

This list is in the order of palatability as determined in March and April (after a dry period), when the grasses had made three weeks' growth after cutting. In an experiment carried out in May and June of the previous year (following continued rain), the same species were isolated, with the addition of *Amphilophis pertusa* and *Panicum meyerianum*. The order of preference among the palatable species varied somewhat at the two different seasons, as was to be expected as the result of different conditions.

Nutritive Value.—The estimation of nutritive value has, of necessity, to be based mainly on chemical analysis at the present stage of the work. Owing to inadequate staff in the Chemical Section of the Department, considerable difficulty has been encountered in obtaining suitable facilities for the production of chemical data. Recently, however, valuable assistance has been given by Professor Linton of the Royal Veterinary College, Edinburgh.

Most of the species under observation have been analysed. The samples were taken in connexion with the palatability experiment at the end of the long dry period, just as the rains started. Before being submitted for analysis the sample from each species was separated into leaf and stem. This was done because, in the palatability experiments, the sheep used were observed to take leaf to a much greater extent than stem, which is in keeping with observations made in Great Britain.

An examination of the chemical data has shown no close agreement between the order of preference in the experiment in connexion with which the samples were taken (*see* above list of palatable grasses) and any single chemical constituent of the grasses. It is evident that no one factor of this kind taken alone is sufficient to constitute a reason for the preference shown for a grass. Practically all the species are low in phosphorus as compared with British grasses, and it appears possible that comparatively low calcium content may be either directly or indirectly connected with the low palatability of most of the grasses which were neglected by the animals. Since taking the average calcium content of all twenty-nine species in the experiment, five only out of the group of fifteen palatable grasses show a figure below this average, while among fourteen unpalatable species ten are below the average.

This discussion is based on the chemical data obtained for the leaf portion of the plants (this portion included the leaf sheath, which is usually taken with the stem, but facilities did not permit of the separations being carried further). It can be safely assumed that deficiencies of protein and ash shown by the figures received would be more pronounced in analyses of the whole plant. The stem portion included in some cases a certain amount of " burn," i.e. dried leafage, but in practically every case a definite superiority in composition, as judged from protein and ash, is shown by the leaf portion. This is a result which would be expected, but which it is important to establish on account of its bearing on future work.

The plots on which the palatability tests were carried out, and from which the samples were taken for analysis, occur on the soil type known as the Kikuyu red loam. This soil is markedly acid in reaction, the surface soil having a pH value of about 5.0, and showing a lime requirement of approximately 2½ tons of calcium carbonate per acre. This type of soil is also extremely low in phosphates, although comparatively rich in potash.

The data relating to potassium, sodium and chlorine are not yet to hand, but are expected shortly, and it is intended to include the complete set of figures in a future publication.

Reaction to Management.—Work under this head falls mainly into two sections—(1) the study of the individual species with a view to the development of small areas under more intensive farming conditions, and (2) the determination of the effects of various systems of management; for example, different intensities of grazing, grass burning, etc., on natural pasture, by studying *in situ* the effects of these on the species forming the pasture. The former will also produce information of value in the management of natural pastures, but the development of small, more intensively farmed areas will, at present, only apply to settled districts with good rainfall, where the information being obtained is likely to become increasingly necessary with the growth of dairying and the development of mixed farming. The study of natural pastures is important both to areas under European settlement and those grazed by native herds. The mistakes which have been made in the management of these pastures in a number of countries are already evident in parts of Kenya, and work is progressing with a view to renovating overgrazed areas and avoiding damage to what is at present valuable natural grazing.

Yields.—An experiment has been established with the object of obtaining data on the seasonal yield of the more promising species under conditions of close cutting. Eighteen species are included in this test, and these will be subjected to two systems of cuts. In addition to the aggregate and seasonal yields of herbage, data will be collected on the leaf yields, and yields of nutrients. One of the important results of this experiment will be the evaluation of the species as regards drought resistance. It is hoped to initiate the cuts either during or soon after the March rains.

Seed Production and Establishment from Seed.—It is decidedly improbable that it will be an economic proposition to make extensive use of any herbage plant which cannot be readily established from seed, apart from species which are already dominant in certain areas, or which can be encouraged by management; for example, Kikuyu grass in limited areas. Work has been carried out with a view to determining which of the more promising species can be successfully cultivated from seed. This work has shown that comparatively few of the indigenous grasses are capable of establishment artificially by this method, either for the reason that they produce mostly infertile spikelets, or because they shed their seed before it can be harvested. Outstanding success has, however, been obtained in preliminary work in a few cases. It has been shown that *Cynodon plectostachyum* (19), *Hyparrhenia rufa*, *Panicum* sp. No. 1, *Panicum trichocladum*, and *Amphilophis pertusa* can all be established very readily from seed, while *Chloris gayana* can also be seeded successfully, but will need heavy sowings. All these grasses have been proved palatable in experiments with the exception of *Panicum* sp. No. 1, which it has not yet been possible to test.

Efforts are being made to collect sufficient seed of these and certain other species, with a view to establishing pure pastures to be tested under grazing conditions If this can be obtained, it is proposed to establish the pastures in the March rains, and to run the experiments concurrently with other "Reaction to Management" experiments already set up.

Extension of Work at Veterinary Centres.—In order to obtain information on the behaviour of the promising species under various climatic conditions, simple observational plots are being established at a number of veterinary centres. So far this work is in hand at Ngong, Machakos, Naivasha, and Baraton. In addition to this, steps have been taken to repeat the experiment described under "Yields" at Naivasha, where special facilities are afforded by the staff of the Government Farm.

Veld Management.—With a view to gaining definite information on the effects of different intensities of stocking and also on the effect of grass burning on the most common type of natural pasture—that is, the *Themeda triandra* (red oat grass) type—experiments have been set up at the Veterinary Centres at Ngong and Machakos. Grazing has been in progress at the former centre for the greater part of the year, and will be started at Machakos in March. The effects of the various treatments will be traced by recording the changes in the herbage.

Observations are being made in connexion with these experiments and on the pure species at the Scott Laboratories in order to determine the seeding habits of the common grasses. This is being done with the object of devising and testing a plan of light rotational grazing which will provide for resting parts of the pasture to allow of natural re-seeding.

Manurial Treatments.—In collaboration with the Chemical Section, simple manurial experiments are to be set up in a number of areas. The necessity for obtaining definite information on the effects of the different fertilizers on representative types of herbage and soil has been evident from the start, and it is hoped to lay down the experiments in the near future. The main types of herbage to be dealt with are: (1) *Themeda triandra* (red oat grass), (2) *Pennisetum clandestinum* (Kikuyu grass), and (3) *Cynodon plectostachyum* (star grass). It is realized that the manuring of pasture is in advance of the great bulk of practice in Kenya, but the number of inquiries received on this subject makes it quite clear that the time has arrived when more dependable information should be sought than that which can be given from general principles adapted from knowledge of other countries and from general observations.

Special Reports.—Special reports were submitted on a tour through the Trans Nzoia area in February and March, and the Molo area in July. Both these journeys were undertaken at the request of the Farmers' Associations of the districts concerned.

In the former area the main problem presented was the establishment of pastures on abandoned maize lands, resulting from a desire to undertake mixed farming to a greater extent. In this investigation, transport was provided by the farmers, and it was therefore only possible to make surveys of a few farms. On the information obtained, suggestions were made as to the species which should be tried in small plots by the individual farmers. It is felt that this plan, although capable of yielding the information required, is unlikely to lead to any very satisfactory results, and that the solution of the problem must await the progress of the experiments on the indigenous species at the Scott Laboratories, particularly in respect to the seeding qualities of the grasses.

In the Molo area, the main problem appeared to be the development and maintenance of paddocks near the homestead, and the question of suitable management of the larger areas of the farm. Preliminary observations on the plant succession were made and lines of management which were calculated to maintain Kikuyu grass were indicated for the paddocks, while it was suggested that, following our present information, only very light grazing should be practised on the prevalent *Themeda triandra* (red oat grass) pastures of the large areas.

Several experiments with British herbage species were seen in this district, and although, as the result of information obtained, doubt was expressed as to the ability of the species to persist, it was considered that in this particular area further trials are well worth while.

Distribution of the Herbage Species.—No travelling was done with the express purpose of survey work in view, but advantage was taken of all opportunities of obtaining information in this direction in connexion with other work. A considerable amount of material was received for identification, both from certain sections of the Department and from private individuals. In dealing with the material collected personally and that received from various other sources, an attempt has been made to compile lists showing the distribution of the species. It should be noted, however, that only in very exceptional cases are satisfactory notes on the importance of the species in the various areas received. In most cases, no information that can be relied upon has been obtained, and the fallacy of attempting to conduct survey work in the absence of adequate facilities for travelling cannot be too greatly stressed, especially as in grassland problems ecological considerations are of the utmost importance.

A considerable number of specimens has been prepared for submission to the Royal Botanic Gardens, Kew. In this connexion it is interesting to note that several new species are believed to be represented among specimens already submitted. A number of different forms (possibly different species) of *Cynodon* have been examined microscopically, and specimens have been prepared for submission to Kew. This work indicates that the true *Cynodon plectostachyum* (star grass) is widely distributed in Kenya.

PLANT INTRODUCTION.

The work has progressed under the organization detailed in my report for 1930.

A total of 255 species and varieties of plants were distributed for trial up to the end of the year.

Up to the present, reports on comparatively few plants have been received, and from only certain of the stations. It is therefore too early to express a definite opinion on most of the introductions. The information obtained to date may be summarized as follows:—

Green Manures, Cover Crops, etc.—Poor results in general have been obtained with both cowpeas and soya beans, while notably good results appear to be indicated in the cases of *Calopogonium mucunoides* and *Phaseolus aconitifolius* under the tropical conditions of the Coast area. *Pueraria phaseoloides*, *Canavalia ensiformis*, *Centrosema pubescens*, and *Dolichos hosei* all appear to give promise in that locality. *C. ensiformis* is also reported upon favourably from Bukura, where conditions are decidedly tropical.

It should be noted that no appreciable measure of success has yet been reported to me in this section from stations which experience the more temperate conditions of the highlands.

Food Crops.—Several varieties of maize have shown promise, e.g. Manila Cagayan and Manila Calamba, at the Scott Agricultural Laboratories, Nairobi, and Yellow Menado and Durum at the Coast. Unfortunately, at the former centre, the trials were cut short by locust attacks. Among grain sorghums, several varieties have given promise at the Coast and Bukura. These are Kinyali and Bonganhilo at the former centre, and Blackhull Kaffir at the latter. Awned Bulrush Millet (*Pennisetum typhoideum* vars.) has been reported on from the Coast, and of the varieties tried, the best appear to be a type from Tanganyika and a " late " variety from India (the late maturing quality was not very evident under the conditions of this trial). Other introductions worth noting are a variety of sweet cassava (*Manihot aipi*) from Java and black gram (*Phaseolus mungo*) from Tanganyika at the Coast, Virginia Bunch groundnut at Bukura, and two varieties of haricot bean (*Phaseolus vulgaris*) at the Scott Laboratories. All these have been reported on favourably, although the haricot beans suffered considerably from rust attack.

Forage and Fodder Plants.—No notable success has yet been reported in this section. Certain of the forage sorghums introduced from America seem to show some promise at both Kilima Kiu and Naivasha centres, but further trials are necessary, particularly as disease appears to be important at the former centre. It is likely that locust bean (*Ceratonia siliqua*), introduced from Cyprus, may be a useful fodder tree in the somewhat dry Machakos area where Kilima Kiu is situated. Previous introductions of this plant have been made by private individuals, and the trees, which are three or four years old, appear to give promise. Berseem (*Trifolium alexandrinum*) is worthy of further trial at Naivasha, where it was destroyed in the young stages of growth by locusts.

Oil-bearing Plants.—In this group two sunflower varieties introduced from Rhodesia have been reported on favourably from the Coast area. These are undergoing further trial. It is too early to express an opinion on introductions of coco-nut and oil palm varieties.

Miscellaneous Crops.—This group consists mainly, as far as the present report is concerned, of varieties of beans introduced from South Africa on the strength of a report of an experiment on degree of weevil resistance. From the point of view of yield, at least one of these varieties—namely, Terblanche—has given fairly satisfactory results at the Scott Laboratories. No exact experiments have been carried out yet to determine the degree of resistance to insect attack of the seed produced, but it has been observed that some varieties have been attacked considerably by bean beetles (*Bruchus* spp.).

D. C. EDWARDS.

Appendix III

CHEMISTRY SECTION

Annual Report, 1931.

By The Acting Senior Agricultural Chemist.

ADMINISTRATION.

Staff Changes.

The writer commenced duties on first appointment as Soil Chemist on May 7th, and became Acting Senior Agricultural Chemist from August 12th when Mr. V. A. Beckley went on leave. Messrs. McNaughton and Phillips, the two laboratory assistants in this division, have been on duty throughout the year.

Summary of Work Done.

Inward letters	852
Outward letters	822
Reports on samples, etc.	633
Personal interviews, about ...	400
Total samples examined	1,080
Revenue from analytical work	Sh. 2,154
Travelling	1,702 miles

The higher figure for inward letters is mainly due to acknowledgments of outward advisory letters, and departmental letters received for information only. A good deal of time has been devoted to personal interviews given to settlers. The writer would like to stress the importance of this consultative work, as within a comparatively short space of time visitors are able to submit numerous enquiries to the Agricultural Chemist for his advice. It will be noted that the number of samples received has shown another increase.

Analytical Work.

CLASSIFICATION OF SAMPLES RECEIVED AND REPORTED UPON

	Received	Examined	Refused	Out-standing
Dips	558	540	18	..
Soils	409	244	..	165
Fertilizers	26	22	2	2
Toxicological	71	68	3	..
Wireworm Remedy ..	18	18	..	..
Foods and Feeding Stuffs	22	19	..	3
Coffee	57	57	..	..
Locusts	4	4	..	..
Essential Oils	5	5	..	..
Kresotow	2	2	..	..
Salt Licks	30	5	..	25
Jams	6	6	..	..
Miscellaneous	97	90	..	7
	1,305	1,080	23	202

The total number of samples examined and reported upon is slightly less than the previous year; this drop falling mainly on such analyses as those of cattle dips, feeding stuffs, essential oils and soils. The large amount of soil samples which are outstanding deal with investigational work which is not yet completed, and which will be expedited when more time is available for this kind of work after Mr. Beckley's return from leave. The estimated revenue of Sh. 1,600 for analytical work was exceeded by Sh. 554.

Cattle Dips.

The number of dip samples received has been somewhat less than last year. There has been a slight improvement in the labelling of dip samples, but there is still scope for the exercise of greater precaution as numerous samples still arrive in an unlabelled and broken condition. It is strongly recommended that serviceable boxes should be used for enclosing the dip samples, and that a label should be attached to the bottle stating the name and address of the owner, the registered number of the tank and the nature of the dip wash.

RESULTS OF ANALYSES OF DIP WASHES

Extent of Error	1928		1929		1930		1931	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Within 1 per cent ..	30	5·8	39	6·5	32	5·5	48	8·9
Between 1 per cent and 5 per cent	81	15·8	98	16·3	67	11·6	91	16·8
Between 5 per cent and 10 per cent ..	103	20·1	107	17·8	107	18·5	102	18·9
Between 10 per cent and 20 per cent ..	127	24·8	168	28·0	142	24·5	136	25·2
Over 20 per cent ..	172	33·5	187	31·4	231	39·9	163	30·2
	513	..	599	..	579	..	540	..

There is a decrease in the number of samples which are dangerously above or below strength. Most of those showing over 20 per cent error occurred during the rainy seasons. The majority were over strength due to the practice of some dip owners of guessing the quantity of concentrate that has to be added to the tank to allow for dilution during the rains.

The writer would again like to bring to the notice of every dip owner the necessity of owning and regularly using a field dip tester. A new tester has been designed, and is being stocked by Messrs. Simpson and Whitelaw of Nairobi. The set is easy to manipulate and gives accurate results.

The tick destroying properties of a solution of sodium hypochlorite has been investigated and shown to be entirely unsatisfactory.

During the course of the year thirty-one litres of standard iodine solution have been issued for use with field testers.

TOXICOLOGICAL.

The number of toxicological samples received has shown a further slight increase. This is mainly due to the resumption of the distribution of arsenical poison bait over large areas in the current locust campaign. A positive test for arsenic was obtained in almost every case of suspected arsenical poisoning in baited areas. There is reason to believe that the proportion of poisoned stock is exceedingly low, considering the head of stock in baited areas. However, still further precautions in the handling of poisoned bait and the better control of grazing would further reduce the loss to stock-owners.

Two samples of saliva obtained from race-horses where "doping" was suspected were examined. One sample of saliva was found to show strong positive tests for cocaine, whereas in the other no kind of drug could be detected. In these cases it is necessary to have efficient methods of promptly taking two or three good samples of saliva from horses which are suspected to have been doped.

WATERS.

The chemical section deals with all aspects of water analyses, other than the analysis and report on its suitability for human consumption. Numerous samples of the latter class still arrive at the Scott Laboratories. It should be noted that such work is done by the Government Analyst at the Medical Research Laboratories. Most of the samples dealt with by this section were examined as to their suitability for stock.

FEEDING STUFFS.

Further analyses of locally grown material have been made. *Tritonia laxifolia* (Montbretia) was reported to be very palatable, and analysis showed it to have a nutritive value rather better than average meadow hay. The material, based on air dry weight, contained 11 per cent crude protein, 44 per cent soluble carbohydrates and 2½ per cent of ether extract; whereas the crude fibre content is under 30 per cent. *Digitaria abyssinica* (Couch), mainly in the form of underground stems as cleared from cultivated land, was also found to have a high nutritive value. Much of this material which is collected in the clearing of coffee plantations could be used to supplement stock food under certain conditions.

LOCUSTS.

Work on the nutritive and manurial value of dried locusts, *Locusta migratorioides*, has been continued, and reports on the work have been contributed to the press. Average analyses showed that locusts, air-dried to just one-third of their live weight, constitute a highly nitrogenous organic manure. Their manurial value, collected from three different swarms, is shown by the following data :—

Laboratory Sample No.	Nitrogen	Phosphoric Oxide	Potash
	Per cent	Per cent	Per cent
930	9·09	1·38	0·47
943	10·72	1·28	0·52
944	9·24	1·01	0·50

Their composition is such that when large amounts are available there is a danger of farmers applying excessive amounts of organic nitrogen to the land; about 5 cwt. per acre being a good dressing. It is suggested that locusts, supplemented with small amounts of a phosphatic fertilizer, would be highly suitable for the conversion of very large amounts of more cellulosic material into suitable compost manure.

As a feeding stuff, dried ground locusts form a palatable feed somewhat similar in composition to fish meal or meat meal. Average analyses show them to contain about 55 per cent crude protein, 15 per cent ether extract and 15 per cent crude fibre. It is suggested that this material should be balanced with maize for local consumption or exported as a locust meal. Locusts intended for consumption will naturally have to be collected from areas where no poison bait has been used.

ESSENTIAL OILS.

Indigenous Plants.

Kenya is rich in indigenous scented plants, but most of them unfortunately carry oils that are either very similar to other oils more easily produced, or are distinctly unpleasant.

A number of indigenous plants and plant products have been examined but, while interesting oils have been obtained, there is little hope of these being commercial propositions.

Juniperus procera.—The oil from the wood of the East African cedar is a thick viscous oil, from which, on standing, a large amount of crystalline material may separate in long needles. In colour, it varies from a pale yellow to a dark brown, becoming darker on exposure to light and air.

It appears that the distillation must be carried out under rather exacting conditions as to the nature of the raw material and the distillation methods, otherwise low yields and inferior quality oil may be produced. Samples of cedar wood oil prepared at these laboratories have been fully reported upon by the Imperial Institute. They suggest that a limited quantity of the better oil might have a value of about Sh. 2 per lb.

The yield of oil in laboratory experiments, when low-pressure steam was employed, varies from 1½ to 3 per cent. Probably on a large scale, when high-pressure steam would be employed, a higher yield may be obtained economically. Cedar wood oil, being obtained from a waste product that generally gives a great deal of trouble in its disposal, is perhaps the most promising oil of the Colony.

Muhugu (*Brachylæna Hutchinsii*).—This is a local coastal wood which yields a heavy pale yellow oil having a vetivert like odour. A small sample was despatched to the Imperial Institute for examination. They report that the oil probably consists mainly of sesquiterpenes and sesquiterpene alcohols. They add that it has a persistent odour, which would probably render it suitable for use in soap perfumery and as a fixative. One firm of essential oil distillers in London state that it should find a ready application in heavy perfumes of the oriental type, and estimated its value at between Sh. 10 and Sh. 15 per lb.

Exotic Plants.

Rose Geranium Oil.—Geranium oil has been produced for some time past. Most of it is low in esters, and thus commands a low price. It is believed that the low ester content is mainly a varietal peculiarity (*Pelargonium graveolens*), and trials are now being carried out with several other varieties. Their value remains to be proved.

Lemon Grass Oil.—Lemon grass oil is a pale yellow oil with a very strong odour of lemon; it closely resembles the oil from lemon scented verbena and is often known as verbena oil which it has displaced. The experimental plantings at these laboratories yielded, for the first cut, at the rate of 11,000 lb. per acre, from which about 30 lb. of oil would be obtained. As four such cuttings would be possible each year, an annual yield of about 120 lb. of oil per acre may be expected. Propagative material of the last East Indian variety which has an oil of higher value is being imported.

Eucalyptus citriodora.—Local oil is very different from that from Australia; it most closely resembles citronella oil. The Imperial Institute have reported that a sample sent to them was of good quality, containing a high proportion of acetylisable constituents, probably consisting mainly of citronellal. Unless it could develop a limited market for itself, it would probably have to complete with Java citronella oil which has a low market value.

Peppermint.—There is evidence that peppermint does well in many parts of the Colony; the growth of the ordinary garden mint may be taken as a guide. Different varieties have been imported for trials.

The writer would like to acknowledge the valuable and highly technical assistance which is being rendered by the Imperial Institute, in the possible development of the essential oil industry in the Colony.

A comprehensive account of the possibilities of essential oils, and the best methods for their production has appeared in bulletin form during the year. A further appendix, with numerous designs written in conjunction with Captain T. L. McClelland, upon stills for the production of essential oils, will be published.

COFFEE.

Coffee commands a large proportion of the time of this division in the field and in the laboratory; it also involves a large amount of correspondence in matters dealing with soils, cultivation, drainage, fertilizers, green manuring, compost making, physiological diseases and coffee fermentation.

The green manure and manurial plots at these laboratories have been continued; also, a start has been made to find the relation between the growth of catch crops and cover crops and the conservation of soil water and soil nitrates.

Numerous experimental plots of a simple design have been initiated in different districts; specialized treatment, accompanied by chemical analyses of the tissues, being adopted in experiments connected with physiological diseases. Work is being done on the magnesium, iron, manganese and copper content of healthy and unhealthy tissues. A total of fifty-seven analyses—including coffee berry disease investigations—of bean, cherry and other tissues have been made during the year.

KRESOTOW.

Good kresotow, provided that the coffee trees are properly banded, remains the most effective ant repellent for the control of mealy bug. By laboratory study of what makes a good kresotow ant repellent in the field, it was found possible to draw up a specification required of the material. This has proved helpful in enabling exporters to supply material of fairly uniform quality, but great difficulties appear to have arisen in the preparation of material of the required specification. There is also a difficulty in that ants appear to vary in their behaviour to the same repellent in the different trials. Further work is being done in both field and laboratory to arrive at an ideal kresotow, and to test other coal tar compounds. Americani cloth on cellophane strips over cotton wool, though it entails much labour and expense, has proved to be the best method of banding.

BANDING GREASE.

Late in the year, owing to the uncertainty of supplies of suitable kresotow, trials have been carried out in conjunction with the Entomological Department, using home made " greases " prepared from vegetable and mineral oils and resin; in some cases, additional chemotropic substances have been added. The component ingredients in some twenty greases include castor oil, mineral oils, kresotow, resin, mercuric chloride, bitumen pitch, phenol and pyridine. Field trials up to date have given very promising results, and the ant repellent properties of some of these wlil be followed up over long periods.

The use of cheap, immiscible, non-absorbent materials of the nature of a wax or paint, for the protection of the wood and the holding of the ant repellent, is being investigated.

COFFEE BERRY DISEASE.

In July the writer made a long safari in the Buret–Sotik area investigating the incidence of coffee berry disease and its possible correlation with soil conditions. In these districts there is a fairly wide range of soil conditions, the parent material including archean schists, volcanic tuffs, old river terrace and deep colluval material, and soil water conditions show more variations than in the typical red coffee soils. Coffee berry disease occurred to a varying degree in every shamba visited under all soil conditions, and it became clear from the outset that there was no close field correlation between the one and the other. Further, numerous soil analyses carried out earlier in the year gave no indication of a relationship between the incidence of the disease and soil conditions. The line of delineation of the intensity of the disease was found to be fairly closely related with the boundaries of plantations of different ages and of different cultural treatment. Although it is certain that climatic conditions constitute the dominating factor in the general distribution of the fungus, yet the susceptibility to the disease in local areas, as shown by the intensity of the attack, must depend in some way on the micro-climatic conditions, and the intake of soil nutrients by the coffee tree. It was decided to tackle the problem of any correlation between the disease and soil conditions by analysis of different parts of the tree itself, rather than the soil which contributed to its growth. The intake of nutrients into the tree depends upon the summation of numerous factors, such as available nutrients in the soil throughout the year, soil temperature and water conditions and the local climate. Thus, one could expect a better correlation by analysing the final product of all these growth factors, rather than by arbitary analysis of the soil only, which in many cases does not give the true conditions from the point of view of the plant itself. Detailed chemical analyses have been carried out on the wood, leaves, and berries of healthy and infected trees. As yet the data available is very limited and it is hoped to continue this work on further samples of coffee tissues.

In conjunction with the Senior Coffee Officer and Senior Mycologist a comprehensive programme of experiments is being carried out in the Sotik, and will be continued in the coming year. The investigations include trials of fungicidal sprays, nutrient sprays and application of the main and lesser nutrient ingredients. Perhaps the most promising method of attack is the selection for propagation purposes of individual trees which show marked resistance to coffee berry disease.

SOILS AND SOIL SURVEY.

Up to the present, the writer has had to devote most of his time to the general work of this division, with the result that soil investigational work has been somewhat limited. Most of the total of 402 soil samples, and all the 165 samples outstanding, deal with investigational work; some samples will remain on hand for several years until the completion of that particular line of soil research.

A start has been made on the fundamental nature of the clay fraction of the Kikuyu red loam. It is found to be fairly uniform in chemical composition, containing approximately 50 per cent of sesquioxides, and 45 per cent of silica. It has a silica/alumina ratio (molecular) of about 2.2, and thus approaches a lateritic soil. As soil characteristics and response to fertilisers are intimately connected with the nature of the clay complex, this kind of knowledge enables one to take advantage of soil research work carried out on specific soil types in other parts of the world. Most of the Kikuyu red loam, which is representative of the majority of the coffee acreage of the Colony, is a very deep almost lateritic soil, with highly desirable physical properties and soil water conditions provided that the humus content of the surface soil is maintaned.

Early in the year some lysimeter work was started on the relative losses of nitrate nitrogen from soils, under fallow conditions and when cowpeas and buckwheat respectively were grown and turned in. The drainage water was measured periodically, and nitrate determinations were made over a period of some twelve weeks. The rate of flow of drainage water from six lysimeters showed marked fluctuations, and nitrate losses from duplicate soils did not show good agreement. However, this investigation showed that as much as about thirty pounds of nitrate nitrogen per acre may be lost by leaching from an average maize soil during the long rains of some twenty inches. This emphasizes the vital need of checking, as far as possible, these natural losses of nitrate by growing catch crops and the early planting of maize whenever this is possible. This investigation will be continued, using better control methods to ensure uniformity, for the purpose of evaluating the merits of leguminous and non-leguminous green manures in conserving soil water and soil nitrate throughout the year.

Small scale field trials carried out on the rate of the nitrification of ammonium sulphate in a typical fairly acid red coffee soil, on limed and unlimed plots, have yielded very interesting results. The ammoniacal and nitrate nitrogen content was determined in samples taken at different depths in soils which had receved varying amounts of sulphate of ammonia. There was rapid nitrification within one week, and this continued until all the ammoniacal nitrogen had been oxidized. For average dressings this took some five weeks, whereas in the plots which had received the heaviest dressing some ammonia remained until later. The nitrate content of the soil increased as the ammonia was oxidized. It was highest in the top three inches of soil within three weeks of application, and then the amount rapidly fell away as it passed into the lower soil. The effects of even very heavy applications—50 lb. nitrogen per acre—had entirely passed away from the upper four inches of soil within about ten weeks of application. During this time the rainfall was 6.8 inches and the average soil temperature was 68° F. The retention of large amounts of ammoniacal nitrogen in the upper inch or two of soil, as compared with the rapid downward movement of the nitrate nitrogen as it is formed, is most marked throughout. This work confirms the usual advice to give sulphate of ammonia in small and repeated dressings and to aim at uniform broadcasting of this top-dressing.

Up to the present, it has not been found possible to devote any extended travelling to soil classification and delineation. Some work on the classification of the soils of the Colony has been done during advisory trips; special attention being paid to the climatic factor in soil formation. The Colony, with its wide range of rainfall and temperature variations—from tropic coastal belts to the snow line—offers a great opportunity for such work. Initial observations have been made on such main soil types as chernozems, degraded chernozems, brown forest soils, lateritic red loams, skeletal soils and what made be termed " local soils " which have been formed under special conditions of accumulation and soil water conditions. In this work, much use is being made of field and laboratory data collected by Mr. Gracie, a past officer of this division.

GENERAL.

Exhibits were prepared for the Royal Agricultural and Horticultural Society Show during the year. Its main features were soil profiles, a series of coffee trees showing the symptoms of various enforced nutritional deficiencies, pyrethrum sprays and essential oils. In the dairy class, tests for milk yield and butter fat content were performed.

The simplicity and accuracy of dip testers has been enhanced by the preparation of certain tables for the easy calculation of the quantity of concentrate or water required to be added to the dipping fluid of standard dips.

Some work has been done on the standardization of simple soil field testing outfits for soil reaction and nutrient-status. It is hoped to issue such standardized sets to agricultural officers and others in the near future.

Pot culture work with coffee trees is being continued. It is hoped to correlate a deficiency of not only the main elements of nutrition, but also of others such as iron, magnesium, manganese and sulphur, with certain tree and leaf symptoms.

Recently, a number of mature coffee trees have been given very heavy applications of different classes of fertilisers and other materials, under field conditions. To expedite results, a portion of the dressings was dissolved in water, and poured into numerous auger holes, to a depth of some thirty inches.

Throughout the year work has been continued on the collection of data about the yield, and certain constants of essentials oils, from local and up-country produced plants.

At the close of the year under review, the quarters recently vacated by the Entomological Division were fitted up with suitable laboratory benches, and water and gas laid on. These quarters have been taken over by the Soil Chemist and now provide him with ample accommodation for specialized soil work.

Seven bulletins and articles prepared by officers of this department have been published during the year (*see* general list).

Finally, there remains the pleasure of recording the loyal assistance of Messrs. McNaughton and Phillips, the two laboratory assistants in this division. Mr. McNaughton has specialized in soil investigational work, and Mr. Phillips in the analysis of plant tissues.

G. H. GETHIN JONES.

Appendix IV

SCOTT AGRICULTURAL LABORATORIES

Annual Report, 1931.

By The Officer in Charge.

Administration.

Staff.—The writer was away from the Station from 24th February till 6th October on home leave. During his absence, the work was carried on by Mr. W. G. Leckie, Agricultural Officer.

Travelling.—305 miles were travelled by the Agricultural Officer in charge on duty. 913 miles were travelled by the Clerk in charge.

Revenue.—A total of Sh. 6,836/32 was collected from sale of farm produce, stock and stores and fees for laboratory services during the year.

Correspondence.—Inward letters, 673; outward letters, 652.

Rainfall.—42.93 inches of rain fell during the year, of which 28.34 inches fell during the long rains season and 14.59 inches during the short rains season.

General.—*Offices.*—During the the year changes were made in the allocations of offices to the various sections. By this re-arrangement, it became possible to house the Clerical Section in one block, thus bringing all clerical work under the direct supervision of the Clerk in charge, thereby saving the Scientific Officers a considerable amount of the work which had previously fallen on them to carry out.

Other alterations included the removal of the Entomological Section to one of the Insectaries and the offices of the Agicultural Officers to the main body of the building. The offices and laboratories previously occupied by the Senior Entomologist were subsequently handed over to the Soil Chemist. The old Plant Breeding Laboratory, in which improvements were carried out, was retained by the Officer in charge Grassland Investigation.

The number of visitors to the Station during the year has been most encouraging and it is sincerely hoped that the interest taken by farmers in the experimental work in progress will continue.

FIELD WORK.

The work throughout the year has been greatly hampered by the continuous invasions of locusts, experimental work with cereals being made practically impossible. The twenty-seven acres of land broken up at the end of 1930 carried its first crop during the long rains, the whole plot being planted with maize, with the exception of a small portion being devoted to potato variety trials. Locusts caused considerable damage to the crop. The stand of maize was, however, very variable, clearly indicating that it will take several years to even up the land prior to its being of any use for experimental purposes. It will nevertheless be most useful for multiplication crops, thus liberating land near the offices, which has previously been used for this purpose, for experimental work.

Crops grown were above average, especially the selected seed of Muratha maize, which yielded 15½ bags to the acre.

The wheat crop suffered badly from rust.

Coffee.—The report of the experimental work conducted at this station has been included in the Annual Report of the Senior Coffee Officer.

Wheat.—The 1930 short rain hybrid wheats were harvested by the Plant Breeder in February, 1931. It was unfortunate that during the growing period no rust was prevalent, making selections at harvest time most difficult.

200,000 grains of hybrid wheats were sown singly by hand in April, 1931. Together with these were sown varieties of wheat known to be susceptible to all forms of black stem rust; these were inoculated with black stem rust two or three weeks after germinating to ensure the rust being present amongst the hybrids.

Fifty-one pure-line wheats were sown by a planter in ten plots. One row of each of the fifty-one varieties constituted a plot and each plot was replicated ten times. This experiment was unfortunately destroyed by locusts.

These wheats, together with another fourteen pure-lines, were also planted for multiplication purposes.

Black stem rust and leaf rust were in great evidence during the growing period of the hybrids. The majority were completely destroyed; a few, however, appeared resistant.

It is notable that a new physiological form of black stem rust made its appearance towards the end of the season.

The harvesting of these wheats was carried out in conjunction with the Senior Plant Breeder during August.

During 1930 three plants were found to be free from leaf rust in a badly infected patch of wheat growing on Mr. E. Button's farm, Konza. These plants were brought to the Scott Laboratories and were sown in April, 1931. Two of them proved susceptible to leaf rust when grown here. This indicated that at least two forms of leaf rust must be present in the country.

In November the grains from the third plant, which had proved resistant during the long rains, were planted. Seed of each strain was also inoculated in cages and was in each case unfortunately found to be very susceptible to black stem rust.

Nurseries.—Eighty-nine different seed varieties have been planted in the nurseries for trial. These include a number of indigenous legumes, essential oil plants, shade trees, fruit trees and economic introduced crops.

Imported economic crops for observations.—Small plots of seventy-seven different varieties were planted in the field for trial. Amongst these were included pea varieties, haricot beans, soya beans, crotalarias, clovers, etc. The majority proved unsuccessful, but certain pea and bean varieties are being given further trials.

Potatoes. (a) A rough test on the keeping qualities of several varieties was carried out. The results were :—

A.	Majestic	150 days.
B.	Doon Star	140 ,,
C.	Arran Banner ...	130 ,,
D.	Great Scot	125 ,,
E.	Incomer	120 ,,
F.	The Baron	95 ,,
G.	Alannah	90 ,,

The potatoes were stored in a concrete block building with galvanised iron roof; the light inside is subdued but not dark. Further experiments are being conducted this year. It is of the utmost importance that only good keeping varieties should be recommended to planters as the majority of the crop grown will be for export.

(*b*) The nine varieties of potatoes grown during the long rains gave the following yields :—

VARIETY	Days in Ground	Yield per Acre
		T. c. lb.
The Baron	139	3 6 70
Arran Banner	144	4 3 61
Abundance	144	4 10 50
Doon Star	144	5 4 00
Kerr's Pink	155	5 4 40
Golden Wonder	160	4 13 38
Great Scot	160	5 3 31
Allanah	160	4 17 26
Tinwald Perfection	160	3 6 13

These potatoes have now been grown three seasons from importation and have given the following results :—

VARIETY	WEIGHTS PER ACRE				Position in trial
	Long Rains, 1930	Short Rains, 1930	Long Rains, 1931	Average Yield	
	T. c. lb.	*T. c. lb.*	*T. c. lb.*	*T. c. lb.*	
The Baron	3 12 67	7 0 0	3 6 70	4 13 8	2
Arran Banner	3 4 67	3 5 0	4 3 61	3 1 5	7
Abundance	3 11 0	2 5 0	4 10 0	3 5 74	8
Doon Star	3 4 0	..	5 4 0	4 4 0	5
Kerr's Pink	3 3 45	4 15 0	5 4 40	4 7 65	3
Golden Wonder ..	3 18 89	3 6 70	4 13 38	3 19 65	6
Great Scot	3 10 0	4 5 0	5 3 31	4 6 10	4
Allanah	3 14 89	5 10 0	4 17 26	4 14 1	1
Tinwald Perfection ..	..	3 5 0	3 6 13	3 5 64	9
Majestic	4 9 2	3 0 0	2 2 39	3 3 76	10

It must be noted that the averages of the two varieties Doon Star and Tinwald Perfection are taken for two seasons only.

From observations taken over a period of four years it is believed that certain varieties improve with continual planting in Kenya whilst others deteriorate. From the above table it may be noted how Kerr's Pink and Great Scot have both improved in yield, whereas the variety Majestic shows rapid deterioration. Observations of this nature may be of the greatest value in selecting the most suitable varieties for this Colony.

Lucerne Variety Trials.—The varieties have given seven cuts during the year, the total weights of green matter of the different varieties being :—

Dakota, No. 12	8,724 lb.	Ladak, F.C. 14135	5,152 lb.
Dakota Common	14,336 ,,	Hunter River	19,264 ,,
Cape Province	13,664 ,,	Kansas Common	11,872 ,,
Utah	12,908 ,,	Hairy Peruvian	15,680 ,,
Ladak	5,152 ,,	Grimm	5,600 ,,

VARIETY	TOTAL YIELDS IN LB. PER ACRE				Position
	1929	1930	1931	3 years	
	lb.	*lb.*	*lb.*	*lb.*	
Dakota, No. 12	5,590	13,366	8,724	27,680	7
Dakota Common	8,360	17,392	14,336	40,038	3
Cape Province	9,340	16,958	13,664	39,962	4
Utah	7,780	14,912	12,908	35,600	6
Ladak	3,380	5,163	5,152	13,695	10
Ladak (F.C. 14135)	4,000	5,667	4,480	14,147	9
Hunter River	10,160	20,390	19,264	49,814	1
Kansas Common	8,090	16,729	11,872	36,691	5
Hairy Peruvian	10,390	18,139	15,680	44,209	2
Grimm	5,810	9,377	5,600	20,787	8

Kudzu Vine.—Seed of this crop was imported in 1928, raised in the nurseries and planted out into a small plot during the long rains of 1929. The plants were planted out 10 ft. x 10 ft. A month after planting out growth became rapid and after the short rains, 1929, seven months from planting out, the whole plot was a dense mass of foliage. The first cutting was taken in December, 1929, subsequent cuttings being taken in March, May, October, December, 1930, and in March, 1931. Following this cut the crop suffered badly from die-back. Recovery, however, commenced in October, 1931 and the plot has again resumed its normal vigour. A cut was taken at the end of December. Cuts have averaged three-and-a-half to five tons of green matter per acre.

This crop is well worthy of extensive trial throughout the stock-growing areas as it is highly palatable to all classes of stock and is not eaten by locusts.

Twenty-seven issues of roots to various parts of the country were made during 1931.

Pyrethrum.—The original plot planted out in 1929 has borne heavy flowerings during the year. A further half acre of seedlings has been planted elsewhere. A large number of packets of seed have been distributed over the country for trial during the year.

Green manuring experiment.—The experiment was laid down on a purely demontrational basis to prove the advantages of applying fertilizers to the green manure crop rather than growing the green manure and applying fertilizers to the following cash crop.

One-half of each of two three-acre fields received a dressing of 150 lb. per acre of double superphosphate and 150 lb. per acre of sulphate of potash in October, 1930. The whole six acres were then planted with a green manure (field peas) during the short rains. There was a marked difference in the growth of the field peas on the fertilized halves of each field.

This green manure crop was ploughed under during the first week of January, 1931.

In March, 1931, the unfertilized halves of the two fields received the same dressing of fertilizers.

One three-acre field was planted with field peas and the other with Muratha maize during the long rains.

The yields of the resulting crops were as follows :—

FIELD PEAS.

Artificials+green manure during short rains	Green manure during short rains +artificials prior to planting field peas
531 lb. per acre	489 lb. per acre

Equals and increase of 8·6 per cent.

Muratha Maize.—On this field the Grade I seed gave the following yields :—

Artificials+green manure during short rains	Green manure during short rains +artificials prior to planting maize
18 bags per acre	13 bags per acre

Equals an increase of 38·5 per cent.

It must be stressed that too much significance must not be attached to the actual figures, but the experiment does indicate the best time of applying the fertilizers.

Essential Oil Plants.—During the year the following plants have been established on the farm :—

Lemon grass.
Peppermint (*peperita*).
Peppermint.
Pelargonii capitatum.
P. *gulectifolium.*
P. *myerinifolium.*
P. *peltatum.*
P. *zonali.*
P. *scabram.*
P. *calœllatum* (v. *album*).
P. *radula.*
P. *angulosum.*
P. *iritifolium.*
P. *radula* (v. *rosea*).
P. *grasse.*

Indigenous legumes.—Thirty-seven indigenous legumes have been received and planted out for trial. It is hoped to establish a permanent indigenous legume plot as soon as it is ascertained which of the ones received are perennial.

Work Oxen.—The total number in the Station at the end of the year was thirty-five. This number appears excessive for the number of acres under the plough, but it must be remembered that the land carries two crops a year and the time between harvesting and planting is so short that the preparation of the land has to be carried out with all possible speed.

Mules.—These continue to be a great asset to the farm. For cultivation purposes between maize and coffee they are vastly superior to ox work, while small plots can be ploughed with much greater speed.

Constructional.—Owing to the need for stringent economy the only buildings erected during the year were a small maize crib, which has been badly wanted for many years, and the re-erection of the mule stables and boys' quarters on another site.

STUART GILLETT,
Agricultural Officer.

Appendix V

COFFEE SECTION

Annual Report, 1931.

By The Senior Coffee Officer.

General.

The distribution of the staff during the year was as follows :—

Mr. Bolton was stationed at Head Office and carried out inspections whenever possible in South Kikuyu Province.

Mr. Naismith Jones was posted to Central and North Kikuyu and Ukamba Province. Two months of his time were devoted to locust work. He proceeded on leave on the 19th December.

Mr. Stone was stationed in Nyanza Province until the end of July, when he was transferred to Sotik in connexion with Coffee Berry Disease investigational work. Up to the date of his transfer, most of his time was devoted to locust work and inspections in connexion with a campaign against the parasitic weed on maize, *Striga hermonthica.*

Mr. Knight was stationed in the Rift Valley Province until the end of July, when he took over the Nyanza Province from Mr. Stone. About 75 per cent of Mr. Knight's time was spent on locust work and inspections in connexion with maize stalk borer, sugar cane and striga.

Mr. Powell was posted to Nzoia Province and was responsible for inspections in Kaimosi district. In December, he was temporarily transferred to Makuyu for the purpose of making observations on banding against mealy bug with castor oil–resin mixtures prepared by the Acting Senior Agricultural Chemist.

The work covered by the Coffee Section may be divided into the following headings :—

(*a*) Inspections.
(*b*) Administering the Coffee Rules.
(*c*) Experimental work.
(*d*) Advisory work (letters and interviews).
(*e*) Lectures and field demonstrations.
(*f*) Investigational work.

Interviews.—762 interviews were held in my office.

Correspondence.—Inward letters numbered 1,125; outward letters numbered 1,130.

Publications were two in number (*see* general list).

Travelling.—I travelled 5,420 miles on Government duty and was absent from Head Office for 149 days on duty.

Travelling by Staff.—Plant industry inspections, 11,154 miles; locust campaign, 12,666 miles.

Meetings and shows attended.—Eight meetings in the following districts: Sotik, Trans Nzoia and Kiambu; two Council meetings and the Annual General Meeting of the Coffee Planters' Union; the Agricultural Shows held at Nairobi on the 5th and 6th January and at Eldoret on 5th and 6th March. At both these shows I assisted with the coffee judging.

Inspections.—The following is a summary of visits I made during the period under review:—

District.	*No. of plantations visited.*
Donyo Sabuk	7
Thika–Makuyu	18
Ruiru	18
Kiambu	27
Limuru	10
Nyeri	10
Kericho–Buret–Sotik ...	16
Songhor	2
Uasin Gishu	5
Trans Nzoia	36
Eldama Ravine	2
Total ...	151

Plantation inspections were very much disorganized owing to the fact that during the year all the inspectors, at some time or other, were seconded for locust work. 718 plantations were inspected.

Pruning.—During my visits to different districts I gave practical pruning demonstrations. There is a substantial loss sustained by the industry through bad pruning and handling.

With few exceptions planters who have adopted the multiple stem system of growing coffee have not carried out the pruning satisfactorily. Strange modifications are attempted with bad results. The trees are not being pruned in accordance with the principles of that system.

It is considered that if planters made a closer study of the coffee plant they would gain a sounder knowledge of the principles of pruning required under varying circumstances. A mistake which is often made is that of pruning trees which are in a state of " dieback "; such trees should be allowed to recover before being pruned. Another mistake frequently made is that of " handling " too severely.

Movement of Foreign Coffee.—Applications were received from certain coffee merchants in Nairobi to permit of foreign coffees being treated in coffee mills in the Highlands, and that it should be made possible for them to handle this coffee in their godowns in Nairobi for bulking and export. This matter was discussed at a meeting of the Council of the Coffee Planters' Union and it was admitted by all concerned that there is no danger of introducing pests and diseases from the Northern Province of Tanganyika. The Department is now prepared to issue licences, to permit the entry into Kenya, of coffee grown in the Northern Province of Tanganyika for treatment at coffee mills and for bulking for export.

Representations were also made that the ½ lb. samples of foreign coffees permitted to be imported under the Coffee Rules were inadequate, in consequence of a movement among merchant houses in Nairobi towards the purchasing of large quantities of foreign coffee on liquoring quality, as well as on appearance. Amended Rules have been put forward to allow 10 lb samples of foreign coffee to be imported under the same conditions which applied to the ½ lb. samples.

The Council of the Coffee Planters' Union have requested the Department to make representations to the Tanganyika Government regarding the possibility of dealing in Bukoba coffee by means of Government guaranteed samples. The Department was further requested to examine the possibility of the introduction of coffee from Uganda and the Belgian Congo, either on the same lines sanctioned in the case of coffee grown in the Northern Province of Tanganyika, or subject to restrictions of movement and storage. In regard to both these requests, it was pointed out that the importance of the coffee industry to Kenya is such that it should not be endangered by the introduction of free movement of coffees from other parts of East Africa and the Belgian Congo which might be infested by dangerous pests. In this connexion the entomological section is investigating the possibility of effective bulk treatment by fumigation or mechanical heating in order to destroy any pests which may be present in consignments imported into the Colony for trade purposes. Acceptance of the proposals mentioned above depends on the success of these experiments.

Sisal Bags.—The possibility for exporting Kenya coffee in sisal bags was discussed with the Council of the Coffee Planters' Union. Two merchants in Nairobi undertook to make liquoring tests of coffee stored in such bags, and to make trial shipments of coffee in sisal bags to various parts of the world for report on the suitability of the bag.

Liquoring.—A proposal was put forward by the Coffee Planters' Union for an investigation into factors influencing liquoring quality of coffee. The Amani Institute has undertaken to carry out this work and a scheme has been advanced for the collection of data over a large area of coffee and for a period of years. The object of the survey is an endeavour to correlate quality reflected in price obtained with range in climatic, soil and cultural conditions in East Africa. All information furnished by coffee-growers is to be treated as confidential. The Imperial Institute has informed the Department of the arrangements required to be made in London for tests of the liquoring quality of coffee in connexion with the above investigation. In this regard, Messrs. John K. Gilliat & Co., are prepared to undertake the tests in cooperation with Messrs. James Cook & Co., of Mincing Lane, London.

PESTS AND DISEASES.

Mealy Bug.—A serious outbreak of mealy bug occurred in Makuyu, Ithanga and Donyo Sakub areas. In Ruiru, Thika and Kiambu, the mealy bug infestation during 1931 was not so serious as in previous years, but towards the end of the year there was evidence of a severe infestation, thus threatening the 1932 crop. This outbreak was earlier than usual and many planters had not banded early enough. It was also observed that the number of predators seemed to have decreased. No result has been obtained from the manurial experiments directed towards increasing the resistance of the tree to mealy bug. The only practicable preventive measure at present is banding, but this unfortunately is often inefficiently done and applied too late.

A case of root mealy bug was reported from Nyeri.

Antestia has occurred in a more epidemic form than in previous years and is responsible for loss of crop and damage to mature beans.

Leaf-eating caterpillar, *Metadrepana andersoni*, was responsible for defoliating sixty acres of heavy bearing coffee in Nandi. It was also reported on several plantations in Songhor. This caterpillar has occurred in Nyanza Province annually for the past four years. Where control measures are without any loss of time the damage has been slight.

White Borer (Anthores lenconotus).—Inspections carried out in Makuyu–Ithanga district during the early part of the year show that while this pest is more widely distributed, it is well under control. This borer has been discovered on several coffee farms in Kaimosi.

Stephanoderes hampei.—I regret to have to report that this pest is by no means under control in Kericho–Sotik and Kaimosi districts. The movement of coffee from these districts must be closely watched and not permitted to be sold for local consumption unless the coffee goes through a mechanical drier and is certified free from infestation.

Bark-eating Beetle (Gonacephalum simplex).—Serious damage to coffee plants up to three years old has been reported in the Trans Nzoia and Kikuyu Province.

Whitefly (an Aleurodid).—I discovered this pest on a coffee plantation in the Trans Nzoia; approximately four acres were badly affected. Specimens were submitted to the Acting Senior Entomologist for identification and to advise on treatment.

Thrips.—A slight attack of thrips occurred in Nyanza early in the year, but fortunately it did not cause any damage.

Coffee Berry Moth (Thliptoceras octoguttalis), is to be found in every coffee plantation in Kenya and so far has not given any cause for alarm until this year when two plantations in Ruiru suffered from an unusually heavy infestation.

Leaf Miner Moth, may be found wherever coffee is grown in the Colony, but with few exceptions, has caused no severe damage until this year when severe outbreaks occurred on many plantations in several districts. These outbreaks have coincided with the use of arsenite of soda poison bait against Antestia.

Leaf disease.—After a lapse of approximately ten years severe outbreaks occurred throughout the Kikuyu Province and Machakos causing loss of crop and "dieback." Leaf disease is endemic in Nyanza Province and spraying should be carried out as a matter of routine. If planters would only realize the benefits which would be derived from systematic spraying, and carry it out thoroughly, I am of the opinion that the average yield would be increased and "dieback" would not be so general. The coffee bushes being in a healthier condition as a result of spraying would require less drastic pruning and be in a better condition to bear an average annual crop. At the same time systematic manuring must not be neglected.

Coffee Berry Disease.—This is undoubtedly the major disease affecting coffee in Kenya and the loss of crops due to the ravages of this disease is considerable. I do not propose to write fully on the subject as the Senior Mycologist will be dealing with the matter in his report. A coffee planter in Turbo district has got the disease well under control. A few years ago I saw one of the worst attacks of coffee berry disease on this plantation.

Briefly the following is the method of control which he adopts: systematic pruning; collecting and destroying by burning all diseased berries; decropping intermittent flowerings; removing, by pruning, all heavily infected branches. Incidentally these are some of the recommendations I made to Sotik planters at a meeting there in 1926.

In the matter of control of pests and diseases, coffee planters do not always adhere to the recommendations made by the Department. I consider that the Stripping Rules should apply to Coffee Berry Disease as well as to Stephanoderes and Sophronica.

Pests and diseases have become such a serious menace in the Colony that coffee planting will have to be taken more seriously. Consideration will have to be given to the advisability of enforcing compulsory control measures. When one realizes the heavy losses which occur to the coffee crop annually, owing to bad pruning and the ravages of pests and diseases, to say nothing of adverse weather conditions, the Colony's average yield of coffee per acre is extraordinarily good.

Prosecutions.—Two summonses were served on occupiers of coffee plantations during the year for failing to carry out instructions issued under the Diseases of Plants Prevention (Coffee) Rules.

In the first case, the accused was cautioned and ordered to pay costs, Sh. 158/60. In the second case, the accused was fined Sh. 100 and ordered to pay costs, Sh. 200.

Coffee seed inspection.—During the year 1,229 lb. of coffee intended for seed purposes was examined and passed. The quality of coffee sold for this purpose was of a very low standard.

CO-OPERATIVE EXPERIMENTS WITH GROWERS.

Manuring.

Green Manures.—128 samples of seed of a large range of green manure and cover crops were distributed to coffee planters in twenty-five different districts for trial. Planters are submitting reports on the result of these.

Inorganic Manures.—The result of the mealy bug manurial trials is dealt with elsewhere in the report. The manurial trials in connexion with coffee berry disease are dealt with by the Senior Mycologist. A co-operative manurial experiment has been laid down in the Trans Nzoia, designed by Mr. Beckley. During my visits to different districts I took the opportunity of inspecting manurial experiments laid down by various planters. It is regrettable that I have not been able to keep in closer touch with these experiments owing to pressure of other work. The following observations were made on a plantation in Makuyu district : a plot was treated with bone meal at the rate of 200 lb per acre and the adjoining plot was treated with 200 lb. of super- and rock phosphate mixed. Both plots bore an equally good crop and leaf disease occurred in both about the same time. At the end of harvest the coffee bushes treated with super- and rock phosphate had suffered very severely from leaf disease and "yellowing" was much in evidence, whereas the coffee which received bone meal was in a very healthy condition and leaf disease was hardly noticeable.

Two other manurial experiments were inspected in Thika district. The first was treated with diamonphos and the second with super-phosphate. The coffee treated with diamonphos showed a marked response, the growth was vigorous and healthy and the leaves were stiff in texture. The bushes in the control plot were in a debilitated condition and very yellow. The coffee which received a dressing of superphosphate showed very slight response.

Other observations were made on the effect of superphosphates and sulphate of potash in Kiambu, Ruiru and Donyo Sabuk. On the whole the response to supers and potash has been very slight, and where they have been applied on poor soils the response has been nil. There is some evidence to indicate that organic phosphates have given the best results. Planters are advised to carry out small plot experiments with commercial fertilizers. The tendency of late is to purchase large quantities of artificial manures and apply it throughout the plantation without keeping controls. In many instances soil which requires organic manuring is receiving artificials.

It is impossible to estimate the damage caused by soil erosion in terms of £ s. d., but it has created a most serious problem. It is hoped that planters will pay more attention to the growing of green manures and any other form of organic manuring. In the drier districts, coffee growing will become more unprofitable if planters do not resort to measures which will tend to overcome soil deterioration.

It is of the utmost importance to improve the organic matter content of the soil.

Liming.—With the object of improving the growth of coffee which was planted on an old "manyata" site the following experiments were carried out:—

Limuru District. Experiment laid down November, 1929. —Three plots of 150 trees were treated with lime at the rates of 1½, 2 and 3 tons yer acre. The last observations was made in November, 1931, but no beneficial effects were noticed. The trees in the treated plots showed not the slightest improvement when compared with the trees in the control plots.

Kiambu District. Experiment laid down March, 1929.—All the coffee plants which were planted on this site had repeatedly died out until the short rains planting of 1930 was treated with an application of one ton lime early in 1928 and a second application of one-and-a-half tons was made in March of 1929.

It is of interest to note that until the lime was applied the coffee plants failed to grow, but it is too early to say whether the growth is going to be very satisfactory *without* some other treatment.

Shade.—Greater attention is being given to the growing of shade in certain districts. A large range of trees suggested by the Department are under trial. The result of shade trials would have reached a more advanced stage if planters in the past had been more consistent in bringing to finality such trials as they from time to time instituted, either on their own initiative or on the suggestions of the Department.

The following permanent shade trees are under trial Sp. Millettia, *Ficus Mallatocarpa*, *Cordia Holstii*, *Machærium tipu*, *Albizzia fastigata*, *Gliricidia maculata*, *Croton megalocarpon*, *Dalbergia Assainica*, *Derris robusta*, *Acrocarpus fraxinifolius* and two indigenous species.

For temporary shade in cold and wet districts *Sesbania*, *Cytisus alba* and the castor plant are being used. Although the castor plant has given temporary beneficial results, where hail is prevalent, there are many objections to its use. It dies out very rapidly and is subject to attack by borer and root disease. During a prolonged dry spell owing to its surfacing feeding habit, coffee plants in the immediate vicinity are in competition for moisture. It has also been observed that leaf disease is more prevalent on coffee under castor shade.

There are many districts where shade is essential and the problem of finding the most suitable tree or trees can only be solved by continual trials.

OBSERVATIONS ON SELECTED COFFEE TREES.

Five coffee trees have been selected on two plantations. This final selection is the result of observations made over a period of three years. These trees together with others at the Scott Agricultural Laboratories are included in a series. Each tree is lettered as a unit of the series and seed from the individual trees selected on the two plantations will be propagated and planted at the Scott Agricultural Laboratories.

INVESTIGATIONAL WORK AT THE SCOTT AGRICULTURAL LABORATORIES.

The following annual report of the coffee investigational work carried out on the Laboratory fields during 1931 is submitted by Mr. S. Gillett, Agricultural Officer in charge.

General.

The year as a whole is noticeable for the increasing interest taken by coffee planters from all parts in the many activities of this Section. The number of visitors has far exceeded all previous years, and the greatest interest has been shown in the work in progress. Consultations with planters is of the utmost assistance to the officers in the Section and greatly encourages them in their work.

Diseases and Pests.—Antestia was responsible for damaging a small quantity of the crop. Mealy bug became prevalent during the early months of the year, but was successfully controlled by banding. Green scale attacked a number of young trees but was successfully controlled. Large swarms of locusts passed over the Station during the year, but were successfully prevented from resting on the trees at night.

Manuring.—The following manuring has been carried out during the year on the different plots :—

SINGLE-STEM—

Double Superphosphate	100 lb. per acre.
Sulph. of Potash	50 ,, ,,
Sulphate of Ammonia	100 ,, ,,

Field peas as green manure during long rains and short rains season.

MULTIPLE-STEM—

Compost	7½ tons per acre.
Double Superphosphate	100 lb. per acre.
Sulph. of Potash	50 ,, ,,
Sulph. of Ammonia	100 ,, ,,

Field peas as green manure during long rains and short rains season.

KENYA SELECTED—

Mule Dung	11 tons per acre.
Double Superphosphate	150 lb. per acre.

Nandi cowpeas planted ; seed harvested and refuse turned under.

MARAGOGIPE—

Compost	7½ tons per acre.
Double Superphosphate	100 lb. per acre.
Sulph. of Potash	50 ,, ,,
Sulph. of Ammonia	100 ,, ,,

IMPORTED COFFEE VARIETY PLOT—

Njahi as green manure during long rains season.
Field peas and niger oil as green manure during short rains.

COFFEE GREEN MANURIAL EXPERIMENTAL PLOT—

Compost at rate of 12 tons per acre. Green manure varieties.

Crop.—An average picking was obtained during the year from the five single-stem varieties. The multiple-stem varieties yielded considerably heavier. Below are the actual weights of dry parchment coffee obtained from the two different systems (" buni " is not included).

	1929	1930	1931	Average
	Cwt. per Acre	*Cwt. per Acre*	*Cwt. per Acre*	*Cwt. per Acre*
Single Stem	6·8	1·3	4·6	4·2
Multiple Stem	9·0	2·0	8·3	6·4

Over three years picking the multiple-stem variety has given an 34.4 per cent increase in yield over the single-stem. It must be noted here, however, that the multiple-stem is now only in its first cycle, and the comparative yields over the next three years will be of the utmost interest. A decreased yield is to be expected next year, i.e., the first year of the second cycle, but it is anticipated that this will be more than compensated for by the increased crop over the second and third years of this cycle.

The five varieties of Arabica grown on the single-stem system have also been harvested separately and the corresponding weights of the different varieties over a period of three years shown below will be of interest.

	1929	1930	1931	Average of three years	Position
	Cwt. per Acre	*Cwt. per Acre*	*Cwt. per Acre*	*Cwt. per Acre*	
Jacksons ..	9·5	1·0	5·7	5·4	1
Mysore ..	8·3	0·9	3·6	4·4	3
Blue Mt. ..	6·5	1·0	5·3	4·3	4
Mocha ..	6·2	3·1	4·2	4·5	2
Kents.. ..	4·6	0·9	5·6	3·7	5

It must here be mentioned that the Kent's variety carried a very large crop in 1929, but as the trees were showing signs of bad die-back, a large percentage of the crop was stripped prior to ripening in order to allow the trees to recover. This stripping accounts for the small weight of parchment coffee obtained from this variety during that year.

A point of interest which is shown by the above table is that the Mocha variety has carried a fair crop each season over the three years, whereas the other varieties, after the large picking in 1929, suffered from die-back with a consequent small yield in 1930.

Cultivation.—All plots, unless for experimental reasons treated otherwise, have been surface-cleaned only throughout the year, with the exception of opening up furrows with a mouldboard plough for the application of compost manure and the digging in of a green-manure crop. The practice of deep cultivation is not recommended as the coffee tree, being a surface feeder, is severely taxed if its surface roots are continually being cut.

Pruning.—Single-stem varieties.—Only a light pruning was carried out during February of this year.

Multiple-stem varieties.—Pruning on this system was carried out according to rule, all old primaries which had borne two crops being cut off, leaving the young top primaries to bear the crop.

A few trees grown on the multiple-stem system were not pruned in order to demonstrate to visitors the fallacy of leaving the old primaries on the tree. These trees will be of the greatest interest during 1932.

Other demonstrational pruning is that of topping trees at different heights, the theory being that in dry areas trees capped at about 4 ft. will have all the bearing wood that they are able to support without suffering from severe die-back.

Coffee spraying experiment.—The object of this experiment was to find out if carbide mixture sprayed frequently on coffee bushes would have any detrimental effect on the bean. It was found, however, that after spraying the physiological development of the tree was materially altered, which thus opened up an entirely different aspect to the experiment. Observations and times of sprayings are noted below.

The first spraying, using full-strength carbide mixture, was carried out on six trees on 1st April, six trees in the next row being used as controls. All trees had flowered in March. Subsequent sprayings took place on 1st May, 6th June, 8th July and 14th August.

Flowerings which were expected in May and June did not materialize. The flower buds noticed in May were apparently the same as noticed in June and they were still in the "spike stage" on 8th July. The spikes on the unsprayed (control) trees were not so fully developed.

On 3rd July two trees, one sprayed and one unsprayed were watered at the rate of one inch of rain per acre. These trees received another watering on 13th August.

On 20th August a flowering occurred on all the sprayed trees; the watering of the one sprayed tree did not influence the flowering. A day or two later there was a small flowering on the watering control tree, but no flowering occurred on the remaining five unwatered control trees. The control trees appeared at this date to be in the same condition regarding flower buds as they were in May, except on the branches facing north-west.

Subsequent flowerings occurred as below :—

25th September.—A very heavy flowering on the sprayed trees, control trees gave a fair flowering, but estimated as 70 per cent less than the sprayed trees.

5th November.—Another heavy flowering occurred on the sprayed trees, whereas there was only a small one on the control trees.

At the end of the year, the sprayed trees were carrying a very heavy crop and dense foliage, no leaf having occurred during the year, whereas the control trees had a small crop and normal foliage, having been susceptible to the heavy leaf fall which occurs during July and August.

The results of this small experiment have opened up a new field of work in coffee culture. The cost of spraying is small thereby making it quite a practicable proposition. Experiments on a much larger scale are being carried out at this Station during 1932.

Tree Selections and Vegetative Propagation.

Tree.—A start was made during the year on tree selections. Any outstanding tree was earmarked and recorded as a Series. At the end of the year we had eight such trees (Series A–H) selected, while a number of other trees are under observation. In addition to these, five trees have also been selected on coffee plantations outside. All such trees are subjected to frequent inspections and a record of the estimated yield is noted.

The seed from each tree is harvested separately, selected and planted. By this method it is hoped to build up plots of selected trees from the parent plant.

When the methods of vegetative propagation have been mastered, the information derived from these special selections will be invaluable.

Vegetative Propagation.—Work has been continued in this line as and when time has permitted. Budding has been stopped and efforts on grafting and raising stocks from cuttings have been carried out.

A solar propagator was erected and cuttings put in in August, but by the end of the year no roots had formed in spite of the fact that good aerial growth had been obtained.

A certain amount of success was obtained with grafting in the nursery, but grafting in the open proved a failure.

This work is of the first importance and it is hoped that considerably more time will be available for its continuation during 1932.

Stumping experiment.—In order to ascertain, if possible, the best month for carrying out this operation, three trees are being stumped monthly. As the experiment is still in progress it is impossible to give results at the moment.

Shade trees.—The following shade trees are undergoing trial at this Station :—

1. *Gliricidia maculata.*
2. ~~*Millettiaoblata*~~ [*Millettia oblata*].
3. *Dalbergia assamica.*
4. Mukingugu.
5. *Grevillea robusta.*
6. *Ficus sp.*
7. *Cordia holstii.*
8. *Machærium tipu.*
9. *Acrocarpus fraxinifolius.*

Coffee manuring experiment.—This experiment, laid down in the form of two three-sided Latin square, is being continued. The object is to test out the relative values to the coffee bush of organic manures and artificials. Girth and height measurements of all trees were recorded during the year.

GREEN MANURES AND COVER CROPS.

Cover Crops.—Black Mauritius Bean.—This crop is attracting very special attention at the moment. It forms a dense growth, giving a splendid cover and mulch. The crop can be seen growing at this Station at varying ages from two years to three months. If left untouched, it wlil seed about 10–12 months from planting out and show symptoms of die-back, but with the advent of rain fresh luxuriant growth is quickly formed.

Another method of treatment is to slash off the top growth with "pangas" just before the rains, using the "slashings" to mulch the uncovered parts of the shamba; fresh young growth will quickly appear.

The one definite disadvantage of the crop is that it has climbing habits, so that the runners must occasionally be kept clear of the coffee tree. If the runners on either side are brushed back into the centre they tend to cilmb up each other, and so keep away from the coffee bush. This climbing habit, although admittedly a disadvantage, can be easily controlled by a few "totos" going through the shamba about every six weeks and the small expense thus incurred more than compensates the expense of weeding, which is entirely eliminated.

Gotani Bean.—Another cover crop of great promise. It gives a splendid growth and fine cover; does not mulch so well as the black Mauritius bean, but its great advantage is that it does not climb. It has been proved to remain on the land for two years, but possibly by employing the "slashing" method referred to above, it may remain considerably longer. Tests on this method are in progress at the time of writing.

The best method of planting both the black Mauritius bean and the Gotani bean in coffee is to plant one row only between the coffee, spacing the seeds approximately two feet apart in the rows. About twelve to fourteen pounds of seed will be required per acre.

Glycina javanica.—An indigenous legume which is undergoing trial as a cover crop. It produces much finer foliage than the two preivous crops, but after nine months growth from seed has produced a very fine cover. It is too early to give a fuller report on this crop, but it must be ranked amongst those showing distinct progress.

White Lima Bean.—Similar habits to black Mauritius bean but produces a finer growth. Seeds heavily. Produced a dense soil cover and good mulch.

Green manures.—A large number of different crops were tried out as green manures; amongst these the outstanding were :—

Njahi (Dolichos lablab) forms a splendid growth during the long rains, but is unsuitable for the short rains season. Ready to turn under four to five months from planting.

Nandi Cow Pea (Vigna sp.).—The only suitable cow pea yet tried at this Station. Makes splendid growth during the long rains, but not suited to the short rains. Ready to turn under about four months after planting.

Koinange Lupin.—The best lupin so far tried. Makes good growth in the long rains. Ready to turn under about fourteen weeks from planting. Apt to become very " woody " if left late. Lupins do not give such a good soil cover as the majority of the bean and pea varieties.

Canadian Wonder Beans.—Forms a poor growth compared to the other green manure crops. Ready to plough in about ten weeks after planting.

Field Peas.—The most successful legume yet tried for green manuring during the short rains. Makes a splendid growth and is ready to turn under about eight weeks after planting.

Wedge Pea.—Slower in developing than the field pea, but forms a splendid cover. Ready to turn under obout three months from planting.

New Zealand Grass Pea.—Similar to above, except that its foliage is finer and has a more creeping habit.

Crotalaria incana.—An indigenous crotalaria and so far the best tried. Forms a good growth being ready to turn under about fourteen weeks from planting. Becomes very woody if left too late.

Niger Oil.—The most promising non-legume yet tried. Gives a very heavy yield of green matter and is ready to turn under about eight weeks from planting.

Mixtures.—Field peas and Niger oil were tried as a mixture during the short rains with very favourable results. The Niger oil gives a heavy weight of green matter whilst the field pea supplies the legume. The Niger oil tended to support the field peas, thereby encouraging growth. This mixture was ready to turn under eight weeks after planting.

Wash Stops.—Mexican Daisy was introduced during the year as a wash stop and is proving very excellent.

Nurseries.—The following varieties were planted in the nurseries during the year :—

1. Blue Mountain.
2. Mocha.
   BT
3. —— (selection).
   MP
4. Liberica
5. Guatamala.
6. Blue Mountain (imported).
7. Harar.
   E
8. — (selection).
   T
   KENTS
9. ———— (selection).
   T
10. Mysore (from India).
11. Wild coffee seed from Iringa.
12. Marogogipe.
13. Series A.
14. Series B.
15. Series C.
16. Series D.
17. Series E.
18. Series F.
19. Series G.
20. Series H.
21. Series Y.
22. Series W.
23. Series X.

GENERAL.

There are many factors contributing to the comparatively small coffee crops for the season 1931–32. The outstanding causes are losses sustained from the capsid bug, mealy bug, Antestia, and Coffee Berry Disease, from bad pruning and handling, from delayed flowering, and the excessive rainfall in Nyanza.

Coffee growing at the Coast is still in the experimental stage and it is too soon to form any opinion as to whether it will prove a success.

Mr. Humphreys, Agricultural Officer in charge, Coast Province reports : " It appears from the coffee at Kwale and Sokoki that it is desirable to start afresh with trials of coffee on the Coast before it is possible to form any conclusions as to its possibilities. The arrival of Liberica plants from Amani has made this possible and the further supply of seed makes it possible to try it out in different localities. Cover crops have been sown between the Amani plants and present indications are that *Canavalia ensiformis* should be very suitable for this purpose. From the Kwale and Sokoki plants it would appear that such cover crops are very necessary."

The heaviest loss was undoubtedly due to the capsid bug, another big factor was the delayed flowering. Reports were received during the year from many districts that wood which was expected to flower failed to do so. Flower buds which were expected to blossom in March–April did not do so until about the middle of the year, which means that there will be an unusually large crop harvested early in the 1932–33 season.

At the request of the Hon. Director of Agriculture, Tanganyika, I left Nairobi on the 2nd October on a visit to the coffee growing districts in the Northern Province of Tanganyika, namely Kilimanjaro and Arusha. A separate report on this visit has been submitted.

Mr. Kirkpatrick, the Entomologist at Amani, returned with me to Nairobi and he accompanied me to Nyeri, where we inspected several plantations in connexion with the incidence of Thrips, Antestia and Lygus. In December, Mr. Doughty, the Plant Geneticist at Amani, visited Kenya with the object of discussing coffee problems with me and to study coffee growing under varying conditions. We visited several coffee plantations in Kiambu, Ruiru and Limuru. His advice on vegetative propagation and on the selection work which is being carried out was of great assistance and much appreciated.

ARTHUR TRENCH.

Appendix VI

PLANT BREEDING SERVICES
Annual Report, 1931.

By The Senior Plant Breeder.

The staff of the Plant Breeding Services was at full strength during the year and was as follows :—

G. J. L. Burton, Senior Plant Breeder, Plant Breeding Station.

R. J. Lathbury, Plant Breeder, Plant Breeding Station.

N. D. Spranger, Agricultural Officer, Plant Breeding Station.

G. Gamble, Junior Laboratory Assistant, Plant Breeding Station.

H. Moraes, Clerk, Plant Breeding Station.

Colin Maher, Agricultural Officer, Kitale (part time).

R. N. Noble, Junior Laboratory Assistant, Scott Agricultural Laboratories (part time).

Mr. Lathbury is particularly in charge of the wheat breeding at Njoro Plant Breeding Station and Mau Summit.

Mr. Spranger is Farm Manager of the Plant Breeding Station and in charge of all experimental work.

Mr. Gamble assists Mr. Spranger and does much of the selfing of maize plants.

Mr. Maher is the specialist on maize, and is in charge of the maize breeding in the Trans Nzoia in addition to his ohter duties as Agricultural Officer, whilst Mr. Noble is particularly in charge of the wheat breeding at the Scott Agricultural Laboratories and does the rust inoculations on seedling wheats to test their resistance to stem rust.

On termination of Mr. H. J. Taylor's appointment as Agricultural Officer, Nakuru District, Mr. Spranger and Mr. Gamble have carried on the experimental plots at Rongai. Much assistance has also been given to the Agricultural Officer, Trans Nzoia, who has too much work to carry on single-handed at certain times of the year.

Mr. C. A. Thorold, Mycologist, has been stationed on the Plant Breeding Station during the whole of the year and is proving a valuable addition to the team engaged on control of cereal diseases.

In addition to routine correspondence much advisory work was done on subjects connected with arable farming and considerable motor mileage was covered by the staff in carrying on the work at the different stations and in the districts. Farmers' meetings were attended and lectures given whenever advisable.

I judged the wheat and maize sections at the Agricultural Show, the latter in conjunction with Mr. Maher, and attended the 1931 Staff Conference at Nairobi where the investigational work for the year was discussed.

A very successful field day was held at the Plant Breeding Station on 26th August at which about fifty farmers were present. This number was lower than usual owing to the ever present danger of locusts on farms, but, apart from those who attended the field day, just over 100 visited the farm at other times during the year and were shown round by the staff. An address was given at the field day on the work of the station and it is felt that farmers are most appreciative of its value to them. They were particularly interested this year in the large number of new crops being tried out for the first time on the station.

The correspondence and office work undertaken at the Plant Breeding Station has considerably increased during the year since, in addition to the correspondence (routine and otherwise) of the Plant Breeding Staff and Station, there is also that of the Agricultural Officer, Nakuru and Njoro Districts and of the Mycologist, Mr. Thorold. That it is all done so well and readily is a tribute to the willingness and growing efficiency of Mr. Moraes.

WHEAT AND WHEAT BREEDING.

The uncertainty as to price was one of the factors which caused a reduction in acreage under wheat in 1931 to a figure lower than any since 1926.

Another factor was perhaps the serious incidence of disease in 1930, due largely to the damp weather experienced, reducing the country yield to 2.82 bags per acre, which was only 60 per cent of the acre yield of the previous year.

That the acreage under wheat was not further reduced can only be ascribed to the fact that farmers, particularly at the higher elevations, have no other economic crop and are obliged to grow wheat so as to make use of their expensive machinery.

The same factors (except that rust was not one of them) affected the crop grown in 1931, seriously aggravated, however, by locusts, which pest has been mainly instrumental in bringing the 1931 average yield throughout the country to its low figure. This has resulted in the position, unknown since 1925, that there is not only no surplus for export, but there is not enough local wheat for the country's requirements, so that either flour or wheat (for milling locally) must be imported into the country during 1932 well above normal importations.

The risk of damage by locusts, and the uncertainty as to price, coupled with grave fears as to the effect of disease, are almost certain to cause a further serious decline in the acreage put under wheat in 1932. Could the problems of price and disease be satisfactorily solved immediately, there would at once be a change for the better and the industry would be on a sounder footing. The requirements are that the farmer should be reasonably certain of getting at least Sh. 14 to Sh. 15 per bag f.o.r. for first grade wheat coupled with a yield of five bags to the acre, economically produced. Under such circumstances wheat farming would just show a fair profit, and it is probable that, *under the particular conditions obtaining in this country*, wheat-growing should not be undertaken unless there is a fair prospect of such yields or unless world prices improve considerably. In the days when Kenya Governor and Equator wheats were not affected by rust, these yields were obtained and wheat-growing was on a sound basis.

Assuming, as we must, that favourable prices will return, it is clear that the question is one largely of control of disease and necessitates the eradication of certain diseases from the soil and a supply of suitable rust-resistant wheats. It is a statement on the position in this regard that I propose to make the main subject of my report for 1931 on wheat, and to show what prospects there are of supplying the farmer (*who possesses good wheat land and a proper climate for wheat*) with varieties which will enable him to compete successfully with wheat grown in any other country.

DISEASES OF WHEAT.

Before I deal with the subject of rust-resistant wheats, reference must be made to other diseases which are beginning to be felt more severely every year.

Glume Blotch occasionally causes a certain amount of damage, but its incidence is dependant largely on humidity and lack of ventilation and need not be regarded too seriously except when it occurs in conjunction with other diseases.

A far more serious disease is black chaff (a bacterial disease). The possibilities of loss from this disease will be realized when I say that the whole of the wheats tested for comparative yield in the half-drill strip experiments at the Plant Breeding Station in 1931 were completely destroyed by it. The grain was so shrivelled as to be impossible to thresh. Several acres were affected. In several other experiments where wheat was used, results could not be given for the same reason. The disease was also very prevalent in parts of the breeding cage, and Marquis wheat (used as a rust-infection " surround ") was badly damaged by it. It is proving a serious problem in Canada and the frequency of its appearance in fields of wheat in Kenya is somewhat alarming. Wheats which are rust resistant are often susceptible to black chaff. Mr. Thorold is devoting considerable attention to this disease. It is believed that wet treatment of seed is likely to prove more efficacious than dusts, as it penetrates hollows in the grain.

Whilst selection was being made amongst the new hybrids in the cage at Njoro for rust resistance, only those plants were chosen which showed some resistance also to black chaff, so perhaps some progress has already been made in this direction.

The disease appears in *smooth* black markings on the chaff and in strips of black lines on the straw. In bad cases these markings coalesce near the nodes. It can thus be easily distinguished from glume blotch which appears as *rough* black markings, chiefly on the chaff.

Another disease, perhaps more serious than black chaff, has spread to large proportions at the higher altitudes in Kenya. This is " Take All ", a root disease which seriously reduced yields in 1931 by rendering the ears barren of grain. Unless immediate steps are taken to check this disease its further spread is inevitable. Take all is now in the soil and its natural tendency is, when once established, to spread out in ever widening circles. It has alternate hosts to wheat such as couch and allied grasses, and it behoves every wheat farmer to eradicate couch from his cultivated land and nearby it. Further steps to eradicate the disease will be necessary in the form of rotations with other crops. A step forward is being made in this direction by experiments with temporary leys of seed mixtures sown in wheat. In order that full value may be obtained from such pastures, farmers at the higher altitudes should steadily increase their head of stock and aim at a more mixed type of farming.

Rust.—There is little doubt that had we suitable rust-resistant wheats capable of yielding eight to ten bags to the acre in most years on fertile soil, the industry would be on its feet so long as there was not too great a surplus for export at a totally uneconomic price—a position aggravated in the past by an unnecessarily large importation of flour.

The position as regards issues of the new Njoro wheats for altitudes of from 7,000 feet to 10,000 feet, where both stem and yellow rusts are prevalent, was discussed at some length in my Annual Report for 1929. These wheats have now been thoroughly tested out by farmers and some have been found to be very satisfactory, both as to their resistance to those two rusts and their agronomic characters. This is in itself a considerable achievement, but two typical lots of these wheats have now been tested in bulk by Mr. Houlden of the Kenya Grain Mills, who has reported that the flour from them is unsatisfactory and the mills could only take about 8,000 bags per annum of such wheats, chiefly for "atta" making.

Some years ago, the general appearance of the grain of these wheats caused me to be doubtful of their milling quality and some small samples were sent to England for test. The report which came back stated that the wheats were satisfactory and therefore it has been disappointing to receive the contrary local report. Nevertheless it is the local report which matters as it is the local mills which mostly use the wheats.

The main points from the local report are that the flour from these wheats has a bad colour and lacks stability. Colour can be artificially overcome to a certain extent, but not stability. This consists in the dough having the ability to stand up for a considerable period. Whilst lack of stability in the dough would not affect the housewife who makes her own bread, it does seriously affect the baker who has to make thousands of loaves at a time.

An inspection of the grain as grown by farmers at the higher altitudes reveals that there is little in common between it and the samples grown at the Plant Breeding Station—

the farmers' sample being inferior in every respect and very much "softer" in appearance. This dissimilarity probably accounts for the contradictory reports.

One of these wheats, however, No. K.2.R.5.(L.2), has been grown by a farmer at an altitude of 7,400 feet during 1931. It not only grew satisfactorily and was resistant to rust, but the sample of grain looks much more promising than when this wheat was grown at 8,500 feet. A milling test will be made of eight bags of this wheat in 1932. If this is satisfactory, this wheat should prove very suitable for altitudes of about 7,000 feet and, of course, owing to its stem rust resistance, for all those areas in the Colony at or below that altitude which have the prolonged rainy season of the maize districts; that is, not the Machakos or Nanyuki areas, but the Njoro, Nakuru, Rongai, Londiani, Burnt Forest and Plateau districts.

For the higher altitudes of 8,000 to 10,000 feet there are two wheats which may prove suitable. Both are of local breeding. The first is numbered N.B.230.A.14.(L). This wheat was tested for several years on Mr. Patten's farm at Upper Gilgil (who in those days kindly used to lend me land for such experiments) and has for the last four years been grown by a farmer at Molo (about 8,500 feet). At Upper Gilgil this wheat always showed itself fairly resistant to yellow rust and only on one plot was it ever at all seriously attacked by stem rust. During the last four years at Molo it has never shown any signs of stem rust nor has it been bady attacked by yellow rust. The grain has several times been sent in bulk to the mills and, whilst not of first class quality, is quite acceptable. It is quite probable therefore that this wheat will prove good enough to carry on the wheat industry at the higher altitudes.

Wheat No. N.B.230.A.14.(L) is probably fairly resistant to yellow rust and similarly resistant to stem rust. It has never been tested in the seedling stage for physiological resistance to stem rust since it had once shown some susceptibility in the field; for that reason it was not recommended to farmers, particularly as the other Njoro wheats were known to be really resistant. This wheat is now to undergo tests for physiologic resistance to the several forms of stem rust so that its chances of success may be better known.

There is, however, a further Njoro wheat, No. N.B. 263.H.(L), of the club-headed type, which has been grown for some years at Thomson's Falls and which was referred to in my Annual Report for 1929. This wheat, grown by a farmer for several years at a little over 8,000 feet, has never shown any signs of stem rust or yellow rust and is reported by the farmer to be most satisfactory in every way, including bread-making. As has already been indicated, lack of stability would not be noticed by the farmer but, as the sample of grain produced by this wheat is rather different in type from those Njoro wheats already discussed, a milling test is to be made of it and the results may possibily be satisfactory. If so, the wheat should prove a good second string to No. N.B.230.A.14.(L).

Wheat No. N.B.263.H.(L) is known to be fairly resistant to yellow rust and resistant to the physiologic forms of stem rust, Nos. K1 and K3, but moderately susceptible to form K2. It is on account of its susceptibilty to form K2 that this wheat has not been previously recommended since that form is the one most usually to be found at the higher altitudes. The fact is however that this wheat has not suffered from stem rust for four years on end and therefore may be quite worth the risk of growing.

For those districts in the Colony therefore, which have an eight months' rainy season and which are at altitudes of from 6,000 feet to 9,000 feet, there are at least three possible wheats which may go a long way towards keeping the industry going until better wheats are produced. The wheats are Nos. N.B.230.A.14.(L), N.B.K.2.R.5.(L.2), and No. N.B.263. H.(L). There will be an ample quantity of these wheats for the 1933 sowing. For the highest altitudes there is yet another wheat, No. D.2.E.2.C.4.(L), which is more resistant to stem rust and yellow rust than any of them but of, as yet, doubtful milling quality. For the lower altitudes, say 6,000 feet, there are two more wheats (Nos. B.256.G.1.A. and U.X.9.M.1.A.9.D) which have now been issued to the Rongai district for multiplication and trial. These are entirely resistant to forms K1, K2 and K3 of stem rust but susceptible to yellow rust. This susceptibility is not of much importance at such altitudes. Wheat No. U.X.9.M.1.A.9.D. is also resistant to the new form K4 of stem rust, but the other wheat is susceptible to this form. It is impossible to forecast how often form K4 will appear—probably not very often. These two wheats are probably fairly satisfactory for milling, but, being " soft ", the flour is likely to be lacking in " strength ".

The districts which would be served by the wheats named in the preceeding paragraph are Upper Gilgil and Thomson's Falls, Rongai, Nakuru, Njoro, Molo, Mau Summit, Londiani, Timboroa, Kipkabus, Burnt Forest and Plateau.

The immediate situation with regard to wheat growing in the low altitude districts with two short rainy seasons, such as Machakos and Nanyuki, is that Kenya Standard and Kenya Governor are still the staple wheats, the new one B.F$_4$.2.D.30.B.2.(L) having been discarded. Kenya Governor is the better wheat if it escapes stem rust and Kenya Standard if it escapes leaf rust. Kenya Governor is susceptible to stem rust but resistant to leaf rust, and Kenya Standard resistant to stem rust but very susceptible to leaf rust. Kenya Standard did well in the Nanyuki area in ~~1391~~, but generally 1931 speaking it does not yield better than five bags per acre, whereas Kenya Governor will usually go eight unless it is destroyed by stem rust. Both wheats are satisfactory for milling.

Physiologic Forms of Stem Rust.

A fourth form of stem rust was identified by the Senior Mycologist during the year. This was found on some Kenya Standard at Ulu. The wheat was not at all severely attacked but there was a certain amount of rust present. Curiously enough, another wheat, No. B.F$_4$.2.D.30.B.2.(L), growing next door, was unaffected, though the results from inoculating seedlings of this wheat and Kenya Standard with the new form are identical, showing that they are both moderately resistant physiologically.

Resistance of Certain Varieties of Wheat to Stem Rust and Yellow Rust.

Four physiologic forms of stem rust have now been found in the Colony and the behaviour to them of the wheats already mentioned in addition to Equator and Marquis, is shown in the following table. The first five are resistant to yellow rust.

WHEATS	Form K1	Form K2	Form K3	Form K4
Equator ..	Susceptible	Susceptible	Resistant	?
B.230.A.14.(L)..	?	?	?	?
K.2.R.5.(L.2) ..	Resistant	Resistant	Resistant	Resistant
B.263.H.(L) ..	Resistant	Susceptible	Resistant	?
D.2.E.2.C.4.(L)	Resistant	Resistant	Resistant	Resistant
B.256.G.1.A. ..	Resistant	Resistant	Resistant	Susceptible
U.X.9.M.1.A.9.D	Resistant	Resistant	Resistant	Resistant
Kenya Governor	Susceptible	Resistant	Susceptible	?
Kenya Standard	Resistant	Resistant -	Resistant	Mod. Resist.
Marquis ..	Susceptible	Susceptible	Susceptible	?

WHEAT BREEDING AT THE PLANT BREEDING STATION, NJORO.

This progressed well during the year in spite of locusts. Owing to the suspicion that the Njoro wheats did not possess good milling quality, a number of crosses were made with them as one parent several years ago with a view to improving this quality, whilst retaining rust-resistance. In some cases Kenya Standard also was used to cross with long maturing wheats for the production of new wheats for the higher altitudes.

The following table gives a list of these crosses, the rust-resistance of the parents to the four physiologic forms of stem rust and to yellow rust, and the generation in which the hybrids were in 1931.

CROSS NO. 117—F3 Generation.

A.8.V.12.D.(L)	×Marquis
Resistant to all four forms.	Susceptible to all four forms.
Mod. resistant to yellow rust.	Susceptible to yellow rust.

CROSS NO. 122—F3.

A.8.E.7.E.(L.3)	×Marquis.
Resistant to all four forms.	Susceptible to all four forms.
Mod. resistant to yellow rust.	Susceptible to yellow rust.

CROSS NO. 112—F3.

K.2.R.5.(L.2)	×English hybrid (loaned by Prof. Engledow of Cambridge).
Resistant to all four forms.	Not known.
Resistant to yellow rust.	Resistant to yellow rust.

CROSS NO. 135—F1.

K.2.R.5.(L.2)	×Florence 6.D.
Resistant to all four forms.	Susceptible to all four forms.
Resistant to yellow rust.	Resistant to yellowxrust.

CROSS NO. 136—F1.

K.2.R.5.(L.2)	×Equator.
Resistant to all four forms.	Susceptible to forms 1 and 2.
Resistant to yellow rust.	Resistant to yellow rust.

CROSS NO. 137—F1.

K.2.R.5.(L.2)	×Biffen No. 51.
Resistant to all four forms	Not known.
Resistant to yellow rust.	Resistant to yellow rust.

CROSS NO. 142—F1.

K.2.R.5.(L.2)	×San Martin.
Resistant to all four forms.	Not certain.
Resistant to yellow rust.	Susceptible to yellow rust.

CROSS NO. 143—F1.

B.286 (Kenya Standard).. ..	×Equator.
Mod. resistant to form four.	Susceptible to forms 1 and 2.
Resistant to the other three.	Resistant to yellow rust.
Susceptible to yellow rust.	

Cross No. 145—F_1.

B.286 (Kenya Standard) ..	.. × San Martin.
Mod. resistant to form four.	Not certain.
Resistant to the other three.	Susceptible to yellow rust.
Susceptible to yellow rust.	

Cross No. 146—F_1.

K.2.G.6.A.18.(L)	.. × Equator.
Resistant to all four forms.	Susceptible to forms 1 and 2.
Susceptible to yellow rust.	Resistant to yellow rust.

Cross No. 130—F_2.

K.2.R.5.(L.2)	.. × Florence 5.B.
Resistant to all four forms.	Susceptible to all four forms.
Resistant to yellow rust.	Resistant to yellow rust.

Cross No. 58—F_3.

Red Egyptian	.. × B.F4.3.B.10.V.1.(L).
Resistant to all four forms.	Susceptible to all four forms.
Susceptible to yellow rust.	Susceptible to yellow rust.

Cross No. 131—F_2.

A.8.D.28.B.(L.1)	.. × Florence 5.B.
Resistant to all four forms.	Susceptible to all four forms.
Susceptible to yellow rust.	Resistant to yellow rust.

Cross No. 133—F_2.

C.1.U.3.B.4.F	.. × Equator.
Mod. resistant to all four forms.	Susceptible to forms 1 and 2.
Susceptible to yellow rust.	Resistant to yellow rust.

The most important families are Nos. 117, 122, 112, 135, 136, 143 and 130. No. 112 is perhaps the most promising of them all. Crosses Nos. 117, 122, 112 and 58 were exposed in the F_2 generation (1930) to physiologic forms Nos. K1 and K3 of stem rust and in the F_3 generation (1931) to form K1 again. K1 is an important form. K2, the other important form, was unfortunately not present at Njoro during those years and the resistance of these hybrids to this rust is not known. Seedlings have, however, been grown from some F_4 grains taken from a few F_3 plants out of Cross No. 112. Invariably these seedlings showed themselves physiologically resistant to forms K1 and K3, but only an extremely small proportion have proved resistant to form K2. This is only to be expected, but at the same time it is thought that the inheritance of resistance to form K2 is not dependent on a single factor as is resistance to K1 or K3, so that it is not a simple matter to obtain resistance to this form as well as to the others. *Nevertheless it appears to have been done, though it will be an extremely tricky business selecting the

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* Since writing the above, some doubt has arisen as to whether any plants in Cross 112 are resistant to form K2.

plants resistant to K2, and a successful end to the wheat-breeding experiments seems to be in sight since no great difficulty is anticipated over finding resistance to yellow rust amongst the same wheats. Such resistance to stem rust and yellow rust had already been obtained, of course, in the original Njoro parents, but there is a vast different between the new hybrid wheats and those. The new wheats are altogether better agronomically and have better straw and most important of all, it is not considered that there will be anything unsatisfactory about their milling quality. The grain looks first-class both to the miller and myself.

Black chaff was rampant throughout the breeding cage during 1931, causing havoc amongst the hybrids and Marquis (planted as a " surround "). The plants selected for propagation in the F_4 generation in 1932 were all unaffected by this disease. It is too early to say that these plants are resistant, but it may be so.

These new wheats would be suitable for all districts except those with two short rainy seasons, such as Machakos and Nanyuki. Whilst wheats suitable for these two districts may be found amongst the progeny of crosses 143, 145 and 58, it is more likely that suitable wheats will be found amongst those bred at the Scott Agricultural Laboratories.

Before leaving the subject of the new Njoro wheats, I would like to say that success, if such be achieved, would not have been possible without the immense amount of solid and careful work put in on them by Mr. R. J. Lathbury, especially during the past two years.

It will be at least another five years before these new wheats are in the hands of farmers in any bulk and it may be that this will be exactly five years too late. It is my personal opinion that, unless something unfortunate happens, such as the appearance of fresh virulent forms of rust to which the new hybrids are not resistant, these new wheats will at last place the wheat industry of Kenya on a sound footing. Such forms of rust have not appeared during the past ten years. Meanwhile, if the industry is to survive until that time, the other Njoro wheats and Equator will have to serve, and the price obtained by the farmer must be such as will induce him to carry the risks. The dark shadow of imported Bombay flour once more looms across the scene.

WHEAT BREEDING AT THE SCOTT AGRICULTURAL LABORATORIES.

This has now reached a very important stage, and some idea can now be formed of prospects. The purpose of the work is mainly to improve or produce a better wheat than Kenya Standard. This wheat has been used as one parent in all cases for its resistance to the four physiologic forms of stem rust. The other parents have been chosen with a view to obtaining resistance to leaf rust, better yields, and an improved quality of grain.

The following table gives a list of the crosses, the behaviour of the parents to the different forms of stem rust and to leaf rust, and the generation in which the hybrids were in the long rains season of 1931. These crosses were referred to in my Annual Report for 1928.

CROSS NO. 59—F4 Generation.

Kenya Standard	.. × B.256.C.3.(L).
Resistant to all four forms of stem rust. Susceptible to leaf rust.	Resistant to form K2. Susceptible to the other forms. Mod. resistant to leaf rust.

CROSS NO. 68—F4.

Reverse of Cross No. 59.

CROSS NO. 60—F4.

Kenya Standard	.. × B.F4.3.B.10.V.1.(L).
Resistant to all four forms Susceptible to leaf rust.	Susceptible to all forms. Resistant to leaf rust.

CROSS NO. 64—F4.

Kenya Standard	.. × B.F4.4.C.15.F.4.(L).
Resistant to all four forms. Susceptible to leaf rust.	Susceptible to all forms. Resistant to leaf rust.

CROSS NO. 70—F4.

Kenya Standard	.. × Red Egyptian.
Resistant to all four forms. Susceptible to leaf rust.	Resistant to all four forms. Susceptible to leaf rust.

CROSS NO. 72—F3.

Kenya Standard	.. × Chorlim Selected.
Resistant to all four forms. Susceptible to leaf rust.	Susceptible to stem rust. Resistant to leaf rust.

CROSS NO. 73—F3.

Kenya Standard	.. × B.256.D.19.U.(L).
Resistant to all four forms. Susceptible to leaf rust.	Susceptible to stem rust. Resistant to leaf rust.

CROSS NO. 74—F3.

Kenya Standard	.. × B.256.D.19.X.(L).
Resistant to all four forms. Susceptible to leaf rust.	Susceptible to stem rust. Resistant to leaf rust.

Crosses Nos. 70 and 72 are unimportant, and no selections were made from them in 1931. The most important families are Nos. 60 and 64. Nos. 59 and 68 closely follow them in importance. Wheat No. B.F_4.3.B.10.Y.1.(L) is a very high-yielding type of my own breeding, and very resistant to leaf rust, as is another wheat, No. B.F_4.4.C.15.F.4.(L). B.256. C.3.(L) is another high-yielding type of wheat bred during the past few years, but unfortunately is no more rust-resistant than Kenya Governor, though it yields better. It has been grown successfully on the Plateau. Chorlim Selected is another wheat bred by myself, which grows extremely well, but has not lived up to the hopes previously entertained of its rust-resistance; that is, since the new forms of stem rust have appeared. The wheats in crosses Nos. 73 and 74 are other locally bred wheats of promise as parents in these crosses.

During the long rains of 1930, these hybrids (in an earlier generation then) were all exposed to stem rust form K1, so that the selections made from them in Crosses Nos. 59, 68, 60 and 64 were presumably all resistant to that form. No stem rust appeared during the short rains of 1930-31, so that plants could only be selected for agronomic characters. This was unfortunate, but it is hoped not irremediable. During the long rains season of 1931, form K3 was present, and did great execution. Form K1 was possibly present in August, and also form K4. It is hoped therefore that the selected plants are resistant at least to K3, as well as K1, but rust only appeared in patches throughout the breeding plots, and it is possible that many of the selected plants may only have escaped form K3. The appearance of form K2 is awaited with some trepidation on account of the difficulty in transmitting resistance to this rust. It is in connexion with this form that Crosses Nos. 59 and 68 are so important, although complete resistance to leaf rust cannot be expected from them. Nevertheless wheat No. B.256.C.3.(L) is as resistant to leaf rust as is Kenya Governor, and the latter has never seriously suffered from it.

Immunity to leaf rust appears to have been obtained in many of the plants selected from Crosses 60 and 64, since there was a tremendous infection of leaf rust throughout the breeding plots, and some plants showed no infection.

During the short rains in 1930-31, and again during the long rains in 1931, an unprecedentedly large number of cultures and plants were grown. In the long rains of 1931 the total was a quarter of a million plants. Selection was a tremendous task, and beyond the powers of one man, so that Mr. Lathbury was brought in to help, as well as Mr. Noble and myself. It is hoped that the effort has been worth while.

In addition to the hybrids, five hundred rod-rows of new pure-line wheats were sown for observation and test, as well as a number of small multiplication plots of new wheats. It is clear that Mr. Noble has no small job in hand and that he will have played an important role in the production of wheats better than Kenya Standard, if such is achieved.

Some of the multiplication plots consisted of pure lines resulting from a large number of selections made in the past amongst the natural hybrids found in Kenya Standard. These were particularly selected for a better-looking grain than that of Kenya Standard, and for a measure of resistance to leaf rust.

If these types continue to show improvement over Kenya Standard they should be on the market shortly, though locusts caused considerable loss in 1931. As to new wheats produced from the present hybrids, these, if successful and if all goes well, should be on the market well within five years. Wheats bred at the Scott Agricultural Laboratories should be suitable for the Nakuru, Rongai, Solai, Subukia, Machakos and Nanyuki districts, and also possibly for the Central Plateau.

Stem Rust Inoculation.

Mr. Noble has carried out a large number of routine seedling inoculation of new wheats under the eye of the Senior Mycologist, in order to confirm or otherwise the behaviour to rust of plants in the field. Mr. MacDonald has also done some of this work, but particularly identifications of the different forms of rust present during the year, and I would like to take this opportunity of expressing my appreciation of the close co-operation which exists over this work between the Mycological and Plant Breeding Services. Notwithstanding Mr. Thorold's presence at Njoro, it is thought best to continue doing all the stem rust inoculations at the Scott Agricultural Laboratories. It is no small job also to keep the different forms of stem rust going on in a pure state from season to season, and the inoculations require great care and attention to detail. The importance of the work will be apparent from the discussion which now follows.

Artificial Rust Infections in the Field.

As foreshadowed in my Report for 1930, "surrounds" of rust-susceptible wheats were planted around and between each plot of hybrids at Njoro and the Scott Laboratories. The idea was to infect these surrounds with all the Kenya forms of stem rust, so that the hybrids would be exposed to all of them, and not only to that one which might happen to appear naturally, enabling selection for mature plant resistance to stem rust to be carried out with a high degree of confidence and effectiveness. The assistance of the Mycological Services at the Scott Agricultural Laboratories and Njoro was enlisted, but the experiment proved a failure. It is quite clear that it is not so easy to get such an infection going here as in the U.S.A. or Canada. Nevertheless, the experience gained has been most valuable, and the two services will make a further attempt in 1932, using a variety of methods. A great difficulty, of course, is the large area to be infected, due to the large number of hybrids grown. It is obvious that particular attention must be devoted to the dissemination of form K2, both at Njoro and the Scott Agricultural Laboratories, since the new hybrids have not yet been exposed to it. It may be, however, that it is impossible to spread this form unless conditions are favourable for it; that is to say, the presence of any particular form any year may be due largely to environment.

Mature Plant Resistance.

The importance of spreading infection throughout these "surrounds" becomes clear when I say that Hayes at Minnesota, and Goulden and Neatby at Winnipeg, and their colleagues, found that such a thing as resistance in the field, or mature plant resistance, existed quite apart from seedling resistance; that is, some varieties susceptible in the seedling stage were resistant when fairly mature in the field, and that this resistance was constant whatever physiologic forms of stem rust were present. Since some 63 forms of stem rust are liable to appear in those countries, and no variety is physiologically resistant in the seedling stage to all these forms, this discovery is of the utmost importance. To prove that mature plant resistance of any variety it would only be necessary to start an artificial infection of one form of stem rust in the field and the laborious and unsatisfactory system of seedling inoculations would become unnecessary. Some of these maturely resistant varieties were found by Hart to differ in such a way in stomatal movement from susceptible varieties as to make it more difficult for rust spores to enter, and the term "functional" was applied to this form of resistance. Further researches at Winnipeg have shown, however, that mature plant resistance is not in general due to stomatal movement, and it is possible therefore that the physiology of these varieties alters as the mature stage is reached, so that they are resistant then when not so in the seedling stage.

Some of the varieties which possess this mature plant resistance are Hope, H.44, Pentad and Acme, and they transmit it in a simple way to their progeny when crossed with susceptible varieties. If this mature plant resistance occurred in Kenya it would be a simple matter to produce stem rust resistant wheats by using the above parents for crosses, as has been done in Canada. I have discussed this subject at some length in order to prevent disappointment. A number of the wheats resistant in the mature plant stage on the American continent are to be tried in Kenya in 1932, but it may as well be said now that I tried Pentad, Acme and Marquillo some years ago, and all three showed themselves susceptible to stem rust. Nevertheless, even as things are, it is important to try and obtain artificial infection in surrounds, as it is a much more satisfactory way of finding resistant wheats than by seedling inoculations. Let us hope that form K2 will behave itself and either leave the country entirely or appear shortly in these surrounds.

Leaf Rust.

Field experiments during 1930 and 1931 clearly show that there is more than one physiologic form of leaf rust habitually present in Kenya, and that Kenya Standard is susceptible to them and the wheat B.F_4.3.B.10.V.1.(L) probably resistant. During both 1930 and 1931, Kenya Standard was susceptible and B.F_4.3.B.10.V.1.(L) resistant, but some of the progeny of the cross between these two wheats varied in their resistance during these two years.

Furthermore, during 1930, three foreign plants known as Button 1, 2 and 3, were found in a field of Kenya Standard with no leaf rust on them, though the Kenya Standard all around was smothered with it. The progeny of these three plants was sown at the Scott Agricultural Laboratories in 1931. For some time the progeny of Nos. 1, 2 and 3 were quite free from leaf rust, in spite of severe infection all round. Towards the end of the season, Nos. 2 and 3 became infected, but No. 1 remained clean the whole time. There was other evidence also amongst the hybrids of cross No. 60 that more than one form was present during 1931, at least one of them not occurring until August.

Mr. Noble has been testing the resistance of a few new varieties by seedling inoculation, and has found a very distinct difference in reaction between susceptible and resistant varieties, as has been found before at the University of Minnesota. These routine inoculations may become important in confirming the immunity of plants selected from Cross Nos. 60 and 64, and in determining the degree of resistance of plants selected from Crosses 59 and 68. As in the case of stem rust though, resistance in the field is the important point, and leaf rust is usually much more excessively present in the field "naturally" than is stem rust. The surrounds contain varieties susceptible to leaf rust, as well as some susceptible to stem rust.

Mau Summit.

Several of the new varieties of wheat were grown in the cage at Mau Summit (8,500 feet) for a test of their resistance to yellow rust. This, as has been said before, is the chief object of the work at this Station.

MAIZE AND MAIZE-BREEDING.

The maize industry has suffered enormously from locusts during the year. It is estimated that 50 per cent of the European-grown crop was lost through this cause. Where plants were completely stripped of leaves but cobs had formed, the grain was extremely light and unfit for export.

Apart from locusts, 1931 was a good maize year. Several farmers had adopted the improved methods of maize-growing recommended by the Department in Bulletin No. 6 of 1931, with most encouraging results. It is felt that the time and enthusiasm devoted to this aspect of maize farming has been well spent, and that, so long as soil fertility is maintained and when locusts depart, the results will be seen in greatly enhanced average yields per acre. It is significant that the idea of averaging 20 bags to the acre is no longer regarded by maize farmers as a joke. Further information on this subject will be found in the introduction to Bulletin No. 7 of 1932.

MAIZE SPACING, CENSUS AND PLANTING EXPERIMENTS.

Further maize censuses and spacing experiments were carried out in the maize districts during 1931, and the results confirmed the work done in 1930. It was of interest to find that yields were not affected whether the maize was planted in rows or in hills, nor whether there were two or three plants to a hill. The important point seemed to be that the stand of plants per acre should be adequate, i.e. about 10,000 to 11,000. At the Plant Breeding Station, Njoro, a planting experiment was devised to find the best method in practice of obtaining such a stand. Hill planting was shown, without any doubt, to be the best method, and planting by hand was probably better than by mechanical means. A full discussion of this experiment appears in Bulletin No. 7 of 1932, and of the spacing and census experiments in Bulletin No. 4 of 1932.

MAIZE SEED COMPETITION.

This competition was successfully inaugurated by the Royal Agricultural and Horticultural Society of Kenya, assisted by the Department of Agriculture, during the year. The object of it is to discover the real quality of seed in practice rather than to judge of its quality by appearance. Judging exhibits of so-called seed cobs on the show bench is of little practical value, and the practice has now been discontinued. A full account of the competition appears in Bulletin No. 4 of 1932.

These seed competitions will take place annually, and lectures and demonstrations given on the results at agricultural shows or on farmers' days. Such competitions provide information as to sources of reliable seed and should eventuate in the formation of Seed Associations.

Unfortunately, many of the 1931 plots were destroyed by locusts, but, of those which were harvested, inspection of the cribs revealed that not more than 3 per cent of the cobs were fit for seed. This state of affairs demonstrates the urgent need for an improvement in the country's seed maize. Every farmer should carefully select his seed every year, and those who intend to become seed-growers must pay considerable attention to the matter. There is obviously great room for improvement in the quality of maize grown, and much can be accomplished in this direction by better and continuous selection of seed by farmers.

MAIZE-BREEDING.

The maize-breeding done at Njoro is only a minor part of the maize-breeding programme. Most of the work is done by Mr. Colin Maher in the Trans Nzoia. There is no longer any intention on the part of the Plant Breeding Services to improve and issue better types of maize by means of mass selection. The necessity for every farmer to do such work, the best way to carry it out, and the type of seed to select has been thoroughly proved and demonstrated by experiments, bulletins and example throughout the country during the past few years, and there is no reason now why every farmer should not be able to do the work satisfactorily himself; in fact, he must do it if he means to improve his yields. This leaves the Plant Breeding Services free to concentrate on improvement of maize seed by the production of crossed strains from inbred lines. As has been said elsewhere, this does not necessarily mean that inherently higher-yielding types will be produced than the ordinary Kenya Flat White improved by mass selection. It does mean, though, that where loss in yield from disease is incurred by Kenya Flat Write, that sort of loss would be prevented by maize which has been bred resistant to disease. Selection for resistance in inbred lines is the surest way of producing a disease-resistant, as well as a high-yielding, type of maize, but there will be considerable difficulty in organizing the issue of such maize unless a Seed Association is formed in due course.

Maize-breeding at Njoro Plant Breeding Station.

The seed from fifty selected cobs, resulting from selections made during the past few years for various qualities, was planted up in a breeding plot. One hundred and eighteen plants in this plot were selfed, the plants being chosen for freedom from disease, vigour and other qualities. Of these, 74 were kept for further propagation in 1932. The work at Njoro may result in the production of strains of maize more suitable to such an altitude, and capable of giving higher yields than the mixed type now grown. It is possible also, as a result of this work, that maize may be successfully grown at higher altitudes than has hitherto been the case.

Method of Selfing.

The method of selfing adopted at Njoro and in the Trans Nzoia, and found best under the moist conditions obtaining in this country at the flowering period, is to bag the young cob before it silks. Then, when the tassel has begun to flower, it is cut off and the stem inserted into a small bottle full of water. The tassel in the bottle is then tied to the cob, and cob and tassel bagged. The water in the bottle has to be replenished from time to time. A continual supply of pollen is thus available for the silks, and the pollen is not damaged by rain as it is if the undetached tassel is bagged separately from the silk. In the latter case, the pollen collected in the bag would be shaken over the silks every day. The method used requires less attention than the other and results in better fertilization of the cob.

MAIZE-BREEDING IN THE TRANS NZOIA.

Maize-breeding in the Trans Nzoia should produce more definite results than that done at Njoro, since the objectives are more definite—resistance to White Blight and Fusarium diseases—and the ordinary mixed maize more subject to these diseases there than anywhere else.

The seven paragraphs which follow contain Mr. Maher's report on the maize-breeding in the Trans Nzoia done during 1931. Mr. Maher's work on maize is too well known to require introduction from me:—

"1. The maize-breeding was carried on by kind permission of Estates and Investments, Ltd., Kitale (who enclosed the breeding plots with iron fencing), at Kibomet, 2½ miles from my house.

2. The material available at the beginning of the season was seventeen self-fertilized cobs resistant to white blight (*Helminthosporium turcicum*), four self-fertilized cobs susceptible to white blight, and forty-four cobs selected for resistance to white blight, together with some mixed cobs which had been selected originally for resistance to white blight and the grain of which was planted in a separate block.

3. At the conclusion of the season there were forty cobs which had been inbred for two generations and seventy-six cobs which had been self-fertilized once. The breeding plot was only saved with difficulty from destruction by several swarms of locusts, which did considerable damage at Kibomet.

4. Many of the inbred cobs are displaying a gratifying degree of resistance to white blight. Unfortunately, the task of breeding against this disease is being complicated considerably by the incidence of Fusarium diseases, the severity of which is increased to a large extent by the poverty of the soil and by the fact that the original selections made in 1928 to combat white blight were made out of maize which is very susceptible to the Fusarium diseases; further, the bagging of the cobs during inbreeding creates a local damp atmosphere around the cob, during August rains, which facilitates the entry of cob-rotting organisms.

5. Measures are being taken to increase the fertility of the breeding plots, in order to prevent the lines, weakened by inbreeding to a certain extent, from succumbing to disease through excessively unfavourable conditions.

6. As far as possible, it is endeavoured to secure resistance to the root-, stalk- and ear-rotting fungi. The old roots are turned under in the breeding plot in order to ensure an adequate heavy infection of the soil, in order to give suitable conditions for selection of resistant strains of maize.

7. It is very regrettable that shortage of staff prevents the extension of work on selection of maize of the right type together with inbreeding in the Trans Nzoia, with particular reference to securing relative freedom from losses due to *Fusarium moniliforme* and other kindred organisms."

MAIZE-BREEDING AT THE SCOTT AGRICULTURAL LABORATORIES.

The breeding of improved Muratha maize continues most successfully at the Scott Agricultural Laboratories. The work is done by the Agricultural Officers (European and native side), with my help and advice. The maize has been bred chiefly for early maturity and in recent years attention has been paid to selections of cobs of a disease-resistant type.

An experiment at the Scott Agricultural Laboratories has shown that improved Muratha flat white maize, whilst sufficiently early in maturity to suit the Kikuyu Province, yields about fifty per cent better than ordinary native maize, and would be exportable in the grade K2. This maize should very considerably increase production in the Kikuyu Province, so soon as native agriculturalists pay sufficient attention to good maize farming, as advocated in Bulletin No. 6 of 1931, and elsewhere.

For a variety of reasons, Muratha maize has not been pushed out from the Scott Agricultural Laboratories into the Native Reserves as rapidly as it should have been, but things have now been organized so as to facilitate the issue. Issues will be made to seed farms run by Local Native Councils, and from these seed farms to individual natives. Cob selection will be continued on the seed farms, whilst plant and cob selection is undertaken in the breeding plot at the Scott Agricultural Laboratories.

The quality and popularity of Muratha maize is evidenced by the keenness of individual natives to obtain it for seed.

During 1931 the disease known as white blight was seriously prevalent in parts of the Kikuyu Province and at the Scott Agricultural Laboratories, so that attention was paid to resistance of this disease when plants were selected in the breeding plot. Selection for disease resistance, as well as early maturity, must be continued every year in the breeding plots.

Owing to the difficulties attendant upon organizing the production and distribution of first or second generation crossed maize seed from selfed lines, and since maize-growing by natives has not yet reached, nor is likely within a reasonable period to reach, a standard sufficiently good to warrant such methods of maize improvement, it has been decided for the present to confine out attentions to the production of better seed by mass selection—that is, selection of plants and then of cobs—rather than to undertake the selfing process as is being done at Njoro and in the Trans Nzoia.

EXPERIMENTAL WORK AT NJORO WITH WHEAT.

In order to determine the yielding capacity of some of the new Njoro wheats, as compared with Equator, a series of wheats was compared by the half-drill strip method.

The wheats were compared as follows:—

No. K.2.R.5.(L.2) with—

No. C.I.U.(L) at Njoro.

No. C.12.B.3.F.(L) at Njoro.

No. K.2.G.6.A.9.(L) at Njoro.

Equator at Mau Summit.

In this way a comparison of all four new wheats could be made with Equator. The plots of Equator were dusted with sulphur to prevent stem rust infection. Each comparison covered about an acre. Unfortunately, all the strips at Njoro were destroyed by black chaff, and the strip at Mau Summit by locusts, so that no results were obtainable.

Mr. Lathbury undertook some wheat censuses during the year, and his report follows. Most of the plots were destroyed by locusts, and, since such experiments take up a considerable amount of time and trouble, it is not proposed to continue them until the locust menace has passed.

EXPERIMENTS TESTING THE INFLUENCE OF THE RATE OF SEEDING UPON THE YIELDS OF WHEAT, IN CONJUNCTION WITH CENSUSES.

General farming practice in Kenya points to the suitability of a seed rate of 70 to 75 lb. per acre for quick-maturing wheats of a small tillering capacity, such as Kenya Standard and Kenya Governor, and a rate of 60 lb. for Equator, a slow-maturing and heavy tillering wheat. The experiments were designed to find out what is the most suitable rate for the Njoro wheats, which take a medium to a fairly long period to mature, and which tiller as prolifically as Equator

Censuses were carried out at the Plant Breeding Station, at another farm at Njoro, and at a farm at Mau Summit. All of the experiments but one failed to come to fruition, owing to repeated locust damage. While these Njoro wheats will have to be partially discarded as the result of inferior milling reports recently received, yet they have been used in all the new hybrid crosses owing to their rust resistance, so that the little information available may be of interest.

Nine strips in all were sown at different rates of seeding, from 50 lb. per acre to 100 lb., as shown in Table II; a hundred one-foot sample lengths were marked out in every strip, so that censuses could be made by the method originated by Professor Engledow of Cambridge University.

The number of seeds sown per foot varied with the variety and its bushel weight, apart from the rate of seeding used. The numbers were obtained by counting the number of seeds in a $\frac{1}{4}$ lb. seed sample of each variety; a low bushel weight increases the number of seeds in a given weight :—

TABLE 1.

	Average No. of Seeds per oz.	Bushel Weight
		lb.
Njoro Wheat No. C.1.U	746	55
Njoro Wheat No. D.2.B.4.A.(L) ..	720	56
Kenya Standard	759	58
Equator	704	60

The wheat drills used in this country have no standard spacing distance, and drills having a spacing of 6, 7 and 8 inches between coulters were used. Allowance must be made for this in comparing results.

Table II gives the results of germination counts. It will be seen that the germination percentage varied between 82 and 59. The Njoro Farm counts for wheat No. D.2.B.4.A.(L) are very low. This is due to the fact that the land is on a slope, and a very heavy fall of rain washed a number of the seedlings out of the soil. Drainage trenches or some form of wash stop should have been made on this sloping land to deal with such an occurrence.

Apart from the low counts due to wash (namely, 59, 60 and 64), the average germination per cent is 75.5 for six counts. As laboratory germinations are very high for wheat, the loss must in the main be attributed to climatic conditions, soil cultivation and lack of mechanical efficiency in the seed drill.

Greater attention should therefore be directed to good and proper cultivation and preparation of the seed bed, and to seeding at the appropriate times. The seed drill should also be overhauled and kept in efficient working order. It is of interest to note that wheats sown by hand in the breeding-cage invariably have a germination percentage of between 95 and 100. This is due to the fact that the seed is regularly spaced at a uniform depth and evenly covered in a well-prepared seed bed.

Only one count is available for number of ears per plant, which is 2.87. This is a high figure, and on the evidence of this one count it would appear that with the Njoro wheats the percentage of tillers which form ears is higher than in England, where the ear average for Yeoman is 1.28 and Little Joss 1.85, according to census counts made.

Counts on the number of plants surviving from germination show figures of 71, 86 and 84 per cent.

The yield per ear and weight of 1,000 grains both show very low figures. This was explained in examination of the grain, which was very light and shrivelled, due to an infection of black chaff. Its bushel weight was 54 lb. only.

TABLE 2.

SPACING	8 inches			6 inches					7 inches
VARIETY OF WHEAT	Njoro C.1.U	Kenya Standard		Njoro D.2.B.4.A.(L)					Equator
LOCALITY	Plant Breeding Station	Njoro Farm		Njoro Farm			Plant Breeding Station		Mau Summit Farm
POPULATION—									
Rate of seeding, lb. per acre ..	70	70	100	50	70	90	91	70½	60
No. of seeds sown per foot ..	12·8	9·76	13·94	6·61	9·26	11·90	12·04	9·32	9·05
Plants per foot at germination..	9·97	7·10	9·71	3·90	5·94	7·16	8·87	7·05	7·45
Germination per cent	78	73	70	59	64	60	74	76	82
Plants per foot at harvest ..	7·07	..	..	..	..	..	7·80	5·92	..
Per cent survival from germination	71	..	..	..	..	..	86	84	..
EARS—									
No. of ears per plant	2·87	..	..	..	..	..	..	..	..
EAR SIZE—									
Yield per ear (gm.)	·65	..	..	..	..	..	..	..	..
No. of grains per ear	22·7	..	..	..	..	..	..	..	..
Weight per 1,000 grains (gm.)..	30·0	..	..	..	..	..	..	..	..
YIELD—lb. per acre	1,918	..	..	..	..	..	..	..	..

Examining the census on the C.1.U. Njoro wheat, which was the only one harvested, if the number of samples at harvest is roughly divided into four quarters, the data are as follows :—

TABLE 3.

Plants per ft. at Harvest	Number of Samples	Average Number of Ears per Plant	Average Number of Ears from one ft. run of Drill	Average Yield of Grain from one ft. run of Drill (gm.)
0–4	21	3·8	13	8·4
5–6	25	3·5	19·1	13·0
7–8	28	2·8	21·6	14·6
9–16	26	2·4	24·0	17·9

These figures indicate that the heavier the rate of seeding the higher the yield, in spite of less tillering, but until further censuses have been made such a supposition, based on the results of one census taken for one year only, must be treated with caution.

In succeeding censuses it will be important to adopt different cultural operations, so as to test their effect on the plant population, thus giving information which may result in important modifications in wheat farming practice.

OTHER EXPERIMENTAL WORK.

Reports on other experimental work done at the Plant Breeding Station, carried out by the Agricultural Officer, Mr. N. D. Spranger, under my direction, appear in Bulletins Nos. 3 and 7 of 1932, which have been compiled by the Plant Breeding Staff and the Agricultural Officer, Kitale.

G. J. L. BURTON.

Appendix VII

GRADING AND INSPECTION SERVICES

Annual Report, 1931.

By The Chief Grader and Inspector.

Mr. C. L. Silvester, Chief Grader and Inspector, departed for overseas leave on 18th April, and returned to duty on the 29th November. During his absence, Mr. F. B. L. Butler was in charge of the services.

Mr. D. F. Sargent, Superintendent, Maize Conditioning Plant and Cool Stores, departed on overseas leave on 1st May; he returned to duty on 27th December. Mr. A. E. Taylor was in charge during his absence.

Plant Import Inspection.

The following table shows the quantities and values of the various importations of plants and seeds :—

	Number of Packages	Declared Value	
		Sh.	cts.
Seeds	1,034	45,856	16
Fruit	16,272	143,474	94
Plants	271	9,759	64
Fruit Trees	157	15,638	69
Tea Seed	836	122,450	50
Bulbs	172	3,463	88
	18,742	340,643	81

The number of packages shows an increase of 2,117 over the previous year's figures, but there is a reduction in declared value of Sh. 11,070/96.

In addition, 142 packages, value Sh. 4,958/44 were passed in transit to Uganda.

Grading and Conditioning Services.

Amendments to the Grading of Maize Rules and the Grading of Wheat Rules were gazetted, to enable the artificial drying of grain by individual growers to be brought under the control of Government.

The Agricultural Produce Export Ordinance was applied to beans. The Grading of Beans Rules, 1930 being promulgated with effect from 1st January, 1931.

Early in January exporters of grain intimated that they did not wish to make use of the facilities for the inland inspection of grain. The Assistant Grader and Inspector, who had carried out this work at Kitale during 1930 was withdrawn.

MAIZE GRADING.

(a) Maize Presented Direct for Grading at Coast.

A total of 1,031,704 bags of maize were presented direct for grading and were graded as follows :—

GRADE	Number of Bags	Percentage of Total Received
		Per cent
K2	701,594	68·0
K2 SW	134,141	13·0
K3	39,902	3·86
K3 SW	25,040	2·42
K4	307	·14
K5	170	
K6	597	
K7	2	
K8 FW	872	·28
K8 SW	2,037	
Total Graded ..	904,662	87·68
Rejected—		
Wet	54,872	5·32
Weevily	61,003	5·91
Musty	133	·001
Other Causes ..	11,034	1·07
Total Rejected ..	127,042	12·31
Total Received ..	1,031,704	100

The total of 1,031,704 bags received is an increase of .94 per cent over the total received direct for grading in 1930. It should be remembered, however, that 228,480 bags of maize were presented direct for grading at Kitale during 1930, and further over 70,000 bags of maize were consigned in that year direct to the Conditioning Plant.

An examination of the figures and the percentages thereto gives a clear indication of the condition and quality of the grain received. There are three noticeable features :—

(1) The increase in the percentage of maize graded as K2 when compared with 1930. In the previous year only 37.88 per cent of the maize presented direct for grading was graded as K2. The year under review shows 68 per cent.

(2) Only 5.91 per cent of the maize was rejected owing to excessive moisture content; this is the lowest percentage ever recorded, the previous lowest records being in 1927 and 1929, when 9 per cent was rejected for this cause, whereas in 1930 28.6 per cent was rejected. For the first three months of the year 5.59 per cent of the maize presented was rejected as wet. Similar periods for the years 1927, 1928, 1929 and 1930 show 7.7, 6.2, 14.7 and 41.04 per cent respectively.

(3) Weevily maize was received from the very commencement of the season, due undoubtedly to the very prolonged export season of 1930, and the infestation of the growing crops by weevils.

The following table shows the quantities of wet maize received from the different districts, together with the average moisture contents :—

STATION	Number of Bags	Average Moisture Content
		Per cent
Hoey's Bridge ..	6,088	14·0
Solai	5,851	14·0
Kitale	5,026	13·9
Kampi ya Moto ..	3,404	13·9
Rongai	3,338	13·7
Menengai	2,980	14·2
Nakuru	2,844	14·0
Soy	2,675	14·0
Lugari	1,759	14·2
Sabatia	1,418	14·1
Njoro	1,092	13·9
Plateau	343	15·0
Ol Punyata	310	13·4
All Stations	12,770	Wet by rain

NOTE.—Stations forwarding less than 200 bags of wet maize are not included.

(*b*) *Maize Graded at the Conditioning Plant.*

85,610 bags of maize were graded at the Conditioning Plant after treatment, and were placed in the following grades :—

GRADE	Number of Bags	Percentage of Total
		Per cent
K2	50,365	58·83
K2 C	11,325	13·23
K3	7,031	8·21
K3 C	14,958	17·47
K8 F.W.	547	·65
K8 F.W. C	1,351	1·57
Total Graded ..	85,577	99·96
Rejected : Other causes	33	·04
Total Rejected ..	33	·04
Total Received ..	85,610	100

(*c*) *Maize Regraded.*

Regrading was confined to maize that had been rejected for one or both of the following causes :—

(1) Maize consigned in low quality, or secondhand, bags.

(2) Consignments of maize which were under the prescribed weight permitted for export.

5156 bags were regraded and placed in the following grades :—

GRADE	Number of Bags	Percentage of Total
		Per cent
K2	2,084	40·42
K2 SW	1,744	33·82
K3	30	·58
K3 SW	515	9·98
K8 SW	26	·50
Total Graded ..	4,399	85·31
Rejected—		
Weevily	752	14·58
Other Causes ..	5	·09
Total Rejected ..	757	14·68
Total Received ..	5,156	100

(*d*) *Inland Inspection.*

1,994 bags of maize were inspected at Kitale prior to the withdrawal of the Inspector.

The actual number of bags graded, 1,124,464 (total of (*a*), (*b*), (*c*) and (*d*)) is a decrease of 33.95 per cent as compared with the total of 1,702,520 bags graded in 1930, but is nevertheless the second highest total ever recorded.

SHIPMENTS.

Three hundred and sixteen Export Certificates were issued for 1,000,215 bags of maize comprised as follows :—

Certificates	Bags	
123 for	624,293	(K2) Second Grade.
42 ,,	106,057	(K2 SW) Second grade. Slightly weevily.
12 ,,	11,325	(K2 C) Second grade. Treated by heat for the destruction of weevils.
13 ,,	142,715	(K2 Bulk) Second grade. Shipped in bulk.
17 ,,	21,037	(K2 SW Bulk) Second grade. Slightly weevily. Shipped in bulk.
28 ,,	43,977	(K3) Third grade.
3 ,,	606	(K3 SW Bulk) Third grade. Slightly weevily. Shipped in bulk.
2 ,,	367	(K3 Bulk) Third Grade. Shipped in bulk.
23 ,,	26,545	(K3 SW) Third grade. Slightly weevily.
9 ,,	12,397	(K3 C) Third grade. Treated by heat for the destruction of weevils.
2 ,,	2,561	(K3 C Bulk) Third grade. Treated by heat for the destruction of weevils and shipped in bulk.
2 ,,	2,161	(K4) Flat Yellow.
1 ,,	170	(K5) Round White.
3 ,,	1,498	(K6) Round Yellow.
1 ,,	2	(K7) Mixed.
14 ,,	1,140	(K8 W) Undergrade White.
15 ,,	2,022	(K8 W SW) Undergrade White. Slightly weevily.
6 ,,	1,342	(K8 W C) Undergrade White. Treated by heat for the desctruction of weevils.

Consignments of maize contained in secondhand bags were graded as " Bulk ", also a large number of trucks of short weight maize.

For the second year in succession over 1,000,000 bags of maize were exported.

It is interesting to note that K2 maize was exported to Canada for the first time ; two shipments carrying 138,356 bags of K2 maize left this port in March.

Rule 25.—As permitted under this Rule, 34,070 bags of maize were exported to ports north of Beira and south of Port Said.

Maize General.

The weather conditions which obtained during harvesting operations enabled growers to rail the bulk of their maize in dry condition.

It was pointed out in the Annual Report for 1930 that defective grain due to Pink Ear Rot had increased noticeably during the year, and that the grain was less uniform in size and character than in the preceding year. It is very disquieting to have to report that these features were more noticeable than ever during 1931. The Trans Nzoia, and in particular the Kitale and Hoey's Bridge districts being particularly bad. Lack of care in shelling was on occasions the cause of maize being placed in a lower grade.

WHEAT.

(*a*) *Presented Direct for Grading.*

The following table shows the varieties, the grades and the quantities of wheat which were received at the Coast for grading, and the relative percentages :—

	Equator	Percentage of Total Recd.	Kenya Governor	Percentage of Total Recd.	Other Varieties	Percentage of Total Recd.	Durum	All Varieties Totals of Cols. 1, 2, 3.	Percentage of Total Recd.
K1	4,008	15·87	4,345	60·45	1,013	48·56	NIL	9,366	27·12
K2	5,507	21·80	712	9·90	936	44·87		7,155	20·72
K3	372	1·47	..	..	..	..		372	1·07
Total Graded..	9,887	39·15	5,057	70·35	1,949	93·43		16,893	48·92
Rejected—									
Musty ..	37	·14	76	1·05	1	·04		114	·33
Weevily ..	..	..	2	·02	..	..		2	..
Wet	15,306	60·61	2,043	28·42	133	6·37		17,482	50·65
Other Causes	24	·09	10	·14	3	·14		37	·10
Total Rejected	15,367	60·85	2,131	29·64	137	6·56		17,635	51·07
Total Received	25,254	100	7,188	100	2,086	100		34,528	100
Percentage of Total Received	73·14	..	20·82	..	6·04	..	..	100	..

Other Varieties.—Kenya Standard was the principal wheat placed under this heading.

It will be seen from the above table that 34,528 bags of wheat were presented direct for grading, a decrease of 70.85 per cent on the previous year's total of 118,632 bags.

(*b*) *Grading at the Conditioning Plant.*

16,680 bags of wheat were graded at the Conditioning Plant after treatment and were placed in the following grades :—

K1	K2	K3	Total Graded	Rejected	Total Received
5,656	10,686	338	16,680	..	16,680
33·9%	64·06%	2·03%	100%		

(*c*) In addition 163 bags were graded after sun drying. The total number of bags graded was therefore 51,371 comprised as under :—

(*a*) Received direct for grading	34,528
(*b*) Graded at the Conditioning Plant after treatment	16,680
(*c*) Graded after sun drying	163

Wet Wheat.—17,482 bags were rejected as wet, being 50.65 per cent of the total received, as compared with 81.68 per cent rejected as wet in 1930. The varieties show the following figures rejected for this cause :—

Equator : 15,306 bags being 60.61 per cent of the total received.

Kenya Governor : 2,043 bags being 28.42 per cent of the total received.

Other varieties : 133 bags being 6.37 per cent of the total received.

The following table shows the principal stations from which wet wheat was received, together with the average moisture content :—

STATION	Number of Bags	Average Moisture Content
		Per cent
Molo	5,120	14·3
Mau Summit.. ..	4,314	14·3
Maji Mazuri	1,912	14·6
Eldoret	1,158	14·5
Kipkabus	1,032	14·0
Naro Moru	803	14·4
Lumbwa	789	14·2
Londiani	682	14·1
Nabkoi	624	14·1
Equator	540	14·7
Nanyuki	169	14·4
Plateau	110	14·8
All Stations	186	Wet by rain

NOTE.—Stations forwarding less than 100 bags of wet wheat are not included.

SHIPMENTS.

Sixty-one Export Certificates were issued for 33,549 bags of wheat as follows :—

Certificates	Bags	
19 for	8,663	K1 E. First Grade Equator.
13 „	15,600	K2 E. Second Grade Equator.
3 „	373	K3 E. Third Grade Equator.
12 „	5,114	K1 G. First Grade Kenya Governor.
5 „	1,454	K2 G. Second Grade Kenya Governor.
1 „	333	K3 G. Third Grade Kenya Governor.
5 „	1,249	K1 Wheat.
3 „	763	K2 Wheat.

In addition, 993 bags of wheat were exported to coastal ports.

Equator wheat was reasonably uniform in quality, but very few consignments of strong, bright wheat were received. Shrivelled grain due to rust was in evidence, also pink discoloration of the berry, probably due to scab.

Kenya Governor reached a higher standard than in some previous years.

CONDITIONING PLANT, KILINDINI.

104,414 bags of grain were treated at the conditioning plant, comprised as follows :—

Maize.—Wet	...	61,030 bags.
Weevily	...	26,103 bags.
Wheat.—Wet	...	17,281 bags.

1,382 bags of wet maize were accepted consigned direct to the plant, and charged for at the lower rate.

Except for early in January, when double shifts were worked for a few days, single shifts from four to twelve hours were sufficient to cope with the grain on hand.

The annual overhaul was carried out in June and July. It was found necessary to re-start the plant in August, and intermittent work was done until October, weevily maize and wet wheat being treated.

The plant worked very satisfactorily, no stoppages due to mechanical breakdowns occurring during the season.

Conditioning Plant Extension.

This work can be divided into four phases :—

(1) Laying down of new through sidings.

(2) Extension and enlargement of the storage shed.

(3) Raising of roof to admit of housing of new machinery.

(4) Erection and housing of new machinery.

The first three phases of the work were completed by October. The erection and housing of the new machinery has steadily been pushed forward from that time and by the end of the year was practically completed.

GRADING OF POTATOES.

The following table shows the months and the quantity in hundredweights of potatoes graded, together with the grades :—

MONTH	GRADE IN CWT.			Seed	Rejected	Totals
	1	2	New			
January	..	2,376	..	..	..	2,376
February	..	2,509	..	..	..	2,509
March	..	1,767	..	..	160	1,927
April	..	2,734	..	..	24	2,758
May	..	1,343	197	..	176	1,716
June	..	307	2,699	..	104	3,110
July	1,017	986	3,224	..	56	5,283
August	832	3,374	2,523	..	160	6,889
September	1,059	3,789	1,260	..	..	6,108
October	21	3,943	331	..	..	4,295
November	643	2,576	80	..	..	3,299
December	..	1,479	1,015	..	..	2,494
	3,572	27,183	11,329	..	680	42,764

The total of 42,764 cwt. is an increase of 10.81 per cent over the total graded in 1930, but is a decrease of 36.64 per cent on the total of 67,503 cwt. graded in 1929.

Hand picking was resorted to practically throughout the year. It is pleasing to note that some attempt was made during the latter part of the year to export potatoes of the first quality.

GRADING OF BEANS.

The quantity of beans presented for grading was again very disappointing: only two certificates for 236 bags being issued.

COOL STORES.

The new machinery, which was installed towards the end of 1929, and was out of commission for the greater part of 1930 due to a defective cylinder cover, was re-started in year. Certain delays due to power fluctuations were again recorded.

The old plant was overhauled, the work being completed towards the end of December, but the plant had not passed the necessary tests by the end of the year.

The undermentioned quantities of goods were deposited in the cool stores during the year:—

Commodity.	*Quantity.*
Fruit	181,793 lb.
Fresh fish	59,541 lb.
Cured fish	48,549 lb.
Cheese	18,325 lb.
Offal	3,130 lb.
Poultry	27½ dozen
Butter	5,098 cases.
Beef	363½ quarters.
Mutton and pork ...	276½ carcasses.
Eggs	210 dozen.
Ham and bacon ...	4,970 lb.
Vegetables	312 lb.
Yeast	234 lb.
Serum	18 lb.
Wedding cake ...	40 lb.
Chocolate	122 lb.
Plants	4 cases.

The general depression is reflected in these figures, and for the first time since the cool stores opened a backward tendency is noticeable.

The following table of increases and decreases of the quantities of commodities deposited during the year, as compared with the previous year, gives a clear indication of the position :—

COMMODITY	Increase	Percentage Increase	Decrease	Percentage Decrease
		Per cent		*Per cent*
Fresh Fish ..	18,934 lb.	21·44	..	..
Cured Fish ..	..	..	29,622 lb.	37·89
Fruit	..	..	11,754 ,,	6·07
Cheese	..	..	2,875 ,,	13·56
Offal	..	..	1,319 ,,	29·71
Poultry	..	..	7⅓ dozen	21·04
Butter	..	..	4,303 cases	45·77
Beef	39 qrs.	12·01		
Mutton and Pork	..	..	49 carcases	15·05
Eggs	..	..	597 dozen	73·99
Ham and Bacon	..	..	14,511 lb.	74·49
Vegetables ..	172 lb.	122·85	..	..

VISITORS.

An increasing number of visitors are being received yearly.

ACKNOWLEDGEMENTS.

The thanks of the Department are due to the Port Manager and his staff for their continued help and co-operation.

The work of the Department was carried out in a satisfactory manner during my absence on overseas leave.

C. L. SILVESTER.

ANNUAL REPORT OF THE DEPUTY DIRECTOR (ANIMAL INDUSTRY) AND CHIEF VETERINARY OFFICER FOR 1931.

In accordance with the organization of the Department of Agriculture into two main divisions, this report, covering animal industry, will be divided into the following sections:

- (*a*) Veterinary Administrative and Executive.
    - (i) Settled Areas.
    - (ii) Native Reserves.
- (*b*) Animal Husbandry.
    - (i) Experimental and investigational work at Government Farm, Naivasha (in collaboration with Rowett Research Institute, Aberdeen).

In addition, comments will be made upon the general position of the live stock industry.

The separate reports of the Chief Veterinary Research Officer, Livestock Officer and the Officer in Charge of the Government Farm, Naivasha (Rowett Institute Experiments) are included as Appendices.

It is proposed in future to issue a separate publication periodically embracing the work of the Sub-Division of Veterinary Research.

STAFF AND ADMINISTRATION.

In accordance with arrangement when drafting the 1931 departmental estimates, four stock inspectors were retired from the service on the grounds of age limit, and sanction has been given to fill these vacant positions by younger men during 1932. During the year two appointments of veterinary officers were made to fill existing vacancies caused by transfers or retirement of officers. The movements and establishment of the staff are dealt with elsewhere.

In consequence of the desire of farmers of the Colony to participate in mixed farming, and the increased requests for assistance from the native stockowners, many extra demands were made on the staff of the Administrative and Executive Division, who, in spite of reduction and curtailment of expenditure, rendered loyal service with diligence and perseverance.

MARKETING AND DEPRECIATION.

At a time when agriculture, in all its other branches, is suffering in varying degree from markets that are depressed, unstable and insecure, it is pleasing to report some advancement in animal industry, both in respect of animal disease and productivity. Such exportable products as wool, hides and skins have materially depreciated in value, affecting, in the former case, the European farmer, and, in the latter particularly, the native stockowner. It is at this time a fortunate circumstance that sheep farming in this country is rarely, if ever, practised as such alone, but always in association with other farming activities, principally cattle industry.

The prices of beef and breeding cattle have decreased as compared with the previous year, but supply and demand have remained fairly steady. The position regarding woolled sheep is less satisfactory. Reorganization of method and system in farming operations is taking place, with efforts towards greater economy and production, cardinal principles which should not be forgotten with the restoration of financial stability.

The total production of butter during the year by the Associated Creameries amounted to 1,064,506 lb., of which 613,203 lb. were exported; the remainder was retained as a local reserve, against the possibility of decreased production towards the end of the year. In addition, over 66,800 lb. of cheese was produced, most of which was placed on the local market.

Frequent locust invasions created anxiety and hardship by the destruction of extensive grazing areas, with the result that stock farmers and native stockowners alike were considerably exercised to maintain their herds and flocks in some instances from starvation.

In the settled areas there is a definite inclination towards dairying, and it seems certain that in a few more decades the Colony will become overstocked unless better methods of animal husbandry are practised.

VETERINARY POLICY.

The policy in regard to field veterinary problems is changing in the direction of refraining from the use of virulent material and the consequent creation of active foci of disease, and it is hoped with the advance of veterinary research to resort to measures of complete eradication as the ultimate objective.

VETERINARY RESEARCH.

During the year under review the activities of the Veterinary Research Division comprised, in addition to research, an increased amount of technical routine and administrative work. The technical routine included the preparation of nineteen different laboratory products, serum diagnostic tests, examination of slides and specimens, and technical correspondence, etc. The existing laboratory facilities provide for an increased output of laboratory products. The practice of posting each veterinary field officer to the laboratory for a short course, with a view to acquiring a knowledge of the more recent technique of diagnostic tests which could be conveniently carried out in the field, thus relieving the laboratory of some of the technical routine work, was extended. Research into the diseases of economic importance was pursued, and results of practical utility as well as of scientific importance were obtained.

DISEASE CONTROL.

The situation with regard to the prevalence of stock disease shows marked improvement, and the control of its general incidence, particularly rinderpest, may be said to be due to additional veterinary activities amongst the native stockowners in the reserves, and the gradual reduction of native squatter stock.

Rinderpest.

With the disappearance of rinderpest of bovine origin, the prevalence of this disease in game will cease to play an important part in dissemination, since rinderpest virus is easily destroyed outside the animal body. In view of the different policies adopted for the control of rinderpest by Tanganyika Government and this Colony, and the increasing necessity for co-ordination, a meeting of the chief representatives of the Veterinary Departments of Tanganyika, Uganda and Kenya was arranged in Nairobi in order to discuss a detailed scheme for a campaign of rinderpest eradication. This meeting was held in April; the situation was carefully reviewed, not only from the technical standpoint, but also with regard to financial and political considerations, since it was believed that, apart from technical detail, these considerations were essential for the success of any campaign, and definite resolutions were framed for submission to Government.

These resolutions in brief were as follows, and embodied cardinal and basic principles :—

The control and eradication of rinderpest must receive the active support of the Provincial Administration concerned; it is believed that without this participation a full measure of success cannot be achieved.

The scheme directed to the eradication of rinderpest involves the local but strict enforcement of the Diseases of Animals Ordinance.

The resources of the territories concerned, if necessary, must be pooled, in connection with problems involving control and eradication in inter-territorial zones.

Any therapeutic measures adopted must not involve the use of virulent material in rinderpest-free areas, and that the responsibility in regard to the specific therapeutic measures to be adopted should rest with the Government concerned.

In addition other resolutions were passed, of minor importance, which did not involve important principles.

At a subsequent meeting, at which His Excellency the Governor presided, and representative of all territories concerned, these resolutions were generally agreed to, and an instruction given that steps should be taken to introduce the principles, and that an initial experiment be made in the Kajiado District on the lines recommended, within the limits of departmental expenditure. This work is described in detail later, under the heading of Masai Reserve.

The issues of rinderpest vaccine, which amounted to 28.020 courses, as compared with 11,600 courses in 1930, reflect the increased substitution of vaccination for double inoculation.

Modifications in the technique of preparation of rinderpest vaccine were introduced, which ensured the issue of a product free of bacterial and filtrable virus contamination. The vaccine was found to retain its potency in cold storage for at least six months. This observation is of practical importance in connexion with the maintenance of a reserve stock of vaccine.

It is noteworthy that no outbreaks of natural infection of rinderpest occurred in vaccinated herds.

The duration of the protection conferred by vaccine against a dose of fresh virulent blood was investigated in the field, and the results are recorded in the report of the Chief Veterinary Research Officer.

East Coast Fever.

Attempts were made to introduce a potent serum. Immune cattle were kept continually exposed to a high degree of natural infection for some months and inoculated with large doses of East Coast fever blood rich in parasites, prior to being bled for serum. Results indicate that the serum of immune cattle possesses no prophylactic or curative properties.

The main obstacles encountered in the introduction of a completely successful method of immunization are :—

(1) Artificial transmission of the disease.

(2) The conferring of a solid immunity.

It is anticipated that the investigations into the life-cycle of the parasite in the bovine host which are now being carried out by Dr. E. V. Cowdry, of the Washington University of Medicine, St. Louis, Missouri, in collaboration with Mr. W. B. C. Danks, B.V.Sc., M.R.C.V.S., Veterinary Research Officer, Kabete, will clear up some of the obscure points in the transmission of East Coast fever.

Attempts to transmit East Coast fever to the African buffalo were unsuccessful. Although the African buffalo is a known host of ticks which are potential carriers of the disease, there is no evidence that this animal is a factor in the spread of infection.

There is ample evidence that East Coast fever can be eradicated from infected farms in a dirty area by means of dipping and fencing.

Pleuro-pneumonia of Cattle.

There is a decrease in the incidence of this disease in the settled areas. The demand for vaccine also decreased, 119,884 doses being issued in 1930, as against 46,448 in 1931. The introduction of a vaccine for bovine pleuro-pneumonia enabled Government to adopt a policy of control in the settled areas, which has resulted in the almost complete eradication of this insidious disease in these areas at comparatively little cost.

Unfortunately, bovine pleuro-pneumonia is one of the major diseases in some of the native reserves, and since measures are under consideration for its control and eradication, which may include the application of a serum diagnosis test, investigations with a view to the introduction of such a test suitable for application in the field were commenced.

Redwater and Anaplasmosis.

Imported cattle submitted for immunization were successfully immunized with the vaccine prepared at the laboratory. In addition to a combined redwater and anaplasmosis vaccine, vaccines containing a pure infection of redwater and anaplasma centrale were prepared.

On many estates on which dipping has been regularly carried out for some time, the incidence of redwater and anaplasmosis has been considerably decreased, and therefore it is unsafe to move cattle born and reared thereon to a redwatper and anaplasmosis infected farm. There has consequently been some demand for vaccine for the immunization of valuable country-bred cattle, in particular those born and reared on estates where dipping is regularly carried out.

Ticks and Tick-borne Diseases.

The study of the distribution of ticks in the Colony and of their biology by Dr. E. A. Lewis, Veterinary Entomologist, has brought to light some interesting and valuable information. It tends to indicate the reasons for obscure outbreaks of tick-borne diseases in clean areas; it shows the possibility of eradicating these diseases in dirty areas; and with the additional knowledge of the trend, and the results, of such research in other parts of the world, new avenues of investigations into tick-borne diseases are being discovered.

The natural conditions which affect the distribution of tick species are often complicated by artificial measures of control, and these measures, in turn, vary from farm to farm within the settled areas. In some instances, methods of control are highly efficient; in others they are resorted to only when circumstances demand immediate action, and in others again the methods are adopted with indifference.

The investigations necessary in carrying out a tick survey call not only for a systematic collection of specimens and their identification but also for a study of farm organization, the agricultural pursuits, the topography of the areas surveyed, the general and the particular climatic conditions and the factors which influence them. The number of stock, their movements, and the prevalence of game and their migrations contribute to the propagation and dissemination of ticks.

The close relationship between tick species and the incidence of tick-borne diseases needs further investigation in the field as well as in the laboratory.

In some cases it is now known that more than one species of tick is inculpated in the transmission of a particular tick-borne disease. The existence of the disease is not always a proof of the presence of any one particular species of tick, and as a species usually considered as the chief agent of transmission may not have the opportunity of becoming infected, it does not always follow that, because the area is uninfected with the disease, the usual vecting tick is absent.

Rhipicephalus appendiculatus (the brown tick) is considered the chief transmitter of East Coast fever in the Colony; it is not an abundant pest of the Naivasha district, where only occasional outbreaks of East Coast fever occur. *R. evertsi*, *R. simus* and *R. capensis* are more numerous in the district, and all three species, in a different manner from *R. appendiculatus*, are capable of transmitting the disease. Assuming the absence of the information on the ticks in the Naivasha district, it will be seen that it is incorrect to assume the presence of *R. appendiculatus* because the disease exists; it is equally wrong to state that because the disease is absent, that a particular species of tick is also absent.

It is essential to ascertain the distribution of tick species in relation to the incidence of tick-borne diseases, and to amplify this with transmission experiments in the laboratory.

Laboratory work on the life-cycle and biology of these ectoparasites is based on experiments so arranged as to imitate as closely as possible the conditions in nature. The life-histories of *Amblyomma variegatum* (the variegated tick), *R. pulchellus* (the zebra tick), and *Hyalomma ægyptium* (the bont-leg tick) have been elucidated. This will provide means of carrying out further transmission experiments on tick-borne diseases.

The life-cycle of *H. ægyptium* is of particular value in that it illustrates the influence of vermin in the distribution of the species. On sheep, cattle, and the domestic fowl it behaves as a three-host tick, requiring a separate host for the larval, nymphal and adult stages. On the hare, *H. ægyptium* will feed as a larva, become engorged, moult as a nymph without leaving the host, feed as a nymph on the same individual host, and then drop off the host for moulting. Thus on the hare, the life-cycle requires only two hosts.

This difference in behaviour on certain hosts points to the hare, or some closely allied rodent, as the normal host for the larval stage of *H. ægyptium.*

Further research along these lines will help considerably in estimating the part played by vermin and game in tick-distribution, and the habits of the tick species.

There is no doubt that field investigation is of invaluable assistance to technical research, and it is hoped that closer collaboration with laboratory work will produce results of a very sound, scientific and practical nature, which will be applicable to the improvement of conditions in Kenya Colony.

Fencing of Holdings and Cattle Cleansing Ordinances.

The operation of the Fencing of Holdings and Cattle Cleansing Ordinances is still in abeyance.

The application of these Ordinances would give great assistance to the stock farmers of this Colony, and it is stressed that the joint application to the infected areas (tick-borne diseases) is an urgent necessity, especially in view of the increasing desire for mixed farming, while the application of the Cattle Cleansing Ordinance alone to the clean areas would help to meet immediate requirements for disease control measures, and thus to some extent conform with financial stringency.

Diseases of Animals Ordinance.

During the year the Rules governing the provisions of the Diseases of Animals Ordinance were published in consolidated form as the Diseases of Animals Rules, 1931. Many amendments and additions were made, chiefly concerning the importation of stock into the Colony from overseas and neighbouring territories, and the conditions under which permits may be issued for the movement of stock from, or on to or over any native reserve or native area. Provision was made for the to and fro movement of immune oxen only in the clean areas (East Coast fever). The time limit for the issue of permits for immune oxen was extended from one to three months.

Fees : Laboratory Products.

The schedule of fees for laboratory products was revised, and in this respect issues of fowl pox and fowl typhoid vaccines were made free of charge, but charges were introduced for paratyphoid vaccine, tartar emetic solution, bovine contagious abortion vaccine, and also for the testing of samples of blood for contagious abortion disease.

POULTRY : IMPORTATION RULES.

Rules to protect the poultry industry against the introduction of bacillary white diarrhoea and avian tuberculosis are under consideration.

NATIVE ADVANCEMENT.

Amongst the more enlightened native stockowners there is a growing realization of the futility of keeping a large number of useless cattle merely as a token in their view of visible wealth.

In order to promote the necessary propaganda by actual demonstration instead of verbal expressions, however praiseworthy they may be, requests from Local Native Councils for the establishment of training institutions for their tribes, similar to the successful institutions at Ngong, Maseno and elsewhere, are under consideration.

A scheme for stock conservation amongst the native tribes of the whole Colony has been drawn up. The project is a long-range one, covering a number of years, and contemplates the establishment of African animal husbandry centres throughout the reserves, and provides for disease control supervision. The scheme has been agreed to in principle by the Provincial Administration, and aims at a definite policy for the betterment of the native live stock industry. It can only be introduced gradually when financial circumstances permit.

Native Cattle : Types.

Investigations were made concerning the various types of native cattle distributed throughout the Colony in regard to conformation, coat colour and milk-yielding capacity.

Deterrent Factors.—Definite deterrent factors in regard to the development of the animal industry are the prevalence of disease, relatively low production capacity of stock, overstocking of native reserves, the presence of uncontrolled squatters in the settled areas, illicit movement of stock by natives and itinerant stock traders.

Squatter Stock.—Squatter stock are a menace to the industry in the settled areas of the Colony, since most of the reported outbreaks of contagious disease in these areas are the result of illicit movement to and from neighbouring native reserves.

On the other hand, however admirable it may be from the point of view of a family milk and food supply, etc., that a squatter may move cattle on to, or even acquire cattle while resident on a farm, there is a serious reaction later, particularly if the farm is in any of the East Coast fever free areas, when such cattle are returned to an infected native reserve.

It is now the custom in these areas on farms where regular dipping is carried out for the European owner to insist that all squatter cattle are also dipped, with the object of preventing disease. These cattle are therefore protected on the farm, but exposed to East Coast fever in most of the native reserves after return. Experience has shown that it is not sufficient to tell a native that if he moves his susceptible cattle from a clean area to an infected native reserve in all probability about 90 per cent will die from East Coast fever. This warning is repeated over and over again by veterinary and administrative officers and by the Europeans concerned, all of whom advise the squatters to sell their cattle and buy again in the reserves, but a natural desire for the retention of what he possesses compels him to follow his own inclinations, disbelieving mortality will occur until actually confronted with the loss of his wealth, which perhaps represents years of savings.

This heavy loss is a most unfortunate result of a very unfortunate system, a system which urgently requires administrative consideration and even perhaps statutory reform.

However, most of the squatter stock are to be found in areas principally engaged in plant industry activities, and where conditions with regard to disease approximate to those of their reserves.

FINANCE.

The revenue collected by the field veterinary staff in respect of inoculation and dipping fees during 1931 totalled £12,116, as compared with £15,684 in 1930. This shortfall in revenue may be attributed to (1) the adoption of vaccination in place of the double inoculation method of rinderpest immunization in the settled areas, (2) the decrease in the number of cattle immunized in native reserves, and (3) the scarcity of money among native stockowners.

In addition, £381 was collected by the sale of farm produce, ghee, hides and stock from the African animal husbandry centres. It will be noted that the new source of revenue from the African animal husbandry training centres is shown for the first time, and it is hoped that the amounts will increase considerably as development proceeds.

STATEMENT OF EXPENDITURE AND REVENUE—ADMINISTRATIVE, FIELD AND RESEARCH, VETERINARY SERVICES

1924–1931

YEAR	Actual Expenditure	Revenue Collected
	£	£
1924..	51,009	18,864
1925..	64,769	31,063
1926..	68,313	30,036
1927..	73,778	27,814
1928..	81,184	27,865
1929..	93,773	40,542
1930..	90,660	31,366
1931..	80,071	22,592
£	603,557	230,142

Net Expenditure on Veterinary Services over eight years £373,415.

Expenditure, 1931.

The following is an estimated allocation of expenditure on the Division of Animal Industry, exclusive of Veterinary Research, in respect of native and non-native services :—

(1) Native services	£26,847
(2) Non-native services	£24,715

Revenue, 1931.

The following is the allocation of the revenue collected in 1931, exclusive of Veterinary Research :—

Settled Areas	£3,506	
Quarantine Stations and Native Reserves	£8,610	
		£12,116

The following table gives the total anti-rinderpest inoculations carried out during the year :—

AREAS	Double Inoculations	V.B. Tests	Serum Alone
NATIVE RESERVES AND VETERINARY QUARANTINE STATIONS.			
Machakos Quarantine Station	4,303	267	204
Nandi	12,549	314	..
Central Kavirondo	15,536	..	..
North Kavirondo	3,442	165	..
Kibigori (Quarantine Station), North Kavirondo	7,104	13	104
Coast Province	3,437	..	..
East Suk and Baringo ..	6,228	4,212	..
Isiolo, Northern Frontier Province	..	..	100
Lumbwa Native Reserve ..	6,259	..	..
SETTLED AREAS BY RINDERPEST SERVICE.			
Nakuru	2,767	1,482	30
Nanyuki, etc.	9,806	141	240
Lumbwa	10,158	53	6
TOTALS ..	84,594	6,647	584
Compared with previous year, 1930..	137,299	4,523	78

(a) (i) SETTLED AREAS.

SUMMARY OF OUTBREAKS OF DISEASE IN SETTLED AREAS DURING THE PAST FIVE YEARS.

DISEASE	1927	1928	1929	1930	1931
Rinderpest	73	83	66	34	29
East Coast Fever	31	37	32	33	33
Pleuro-pneumonia	20	8	4	3	1
Blackquarter	22	18	13	93	104
Trypanosomiasis	11	6	9	12	10
Foot and Mouth Disease	22	7	7	44	20
Horse Sickness	8	18	11	20	19
Ulcerative Lymphangitis	42	27	23	8	3
Epizootic ,, ...	7	7	3	3	..
Contagious Bovine Abortion ..	1	9	5	8	29
Swine Fever	2	7	..	3	4
Anthrax	27	43	20	23	25

The general incidence of contagious disease has slightly decreased as compared with last year.

RINDERPEST.

There were twenty-nine fresh outbreaks of rinderpest during the year. The disease occurred chiefly amongst squatter stock and was reported from the following districts :—

> Nanyuki, 6 outbreaks; Lumbwa, 5 outbreaks; Nairobi, 3 outbreaks; Eldoret and Kitale, 11 outbreaks; Nakuru, 1 outbreak and Machakos, 3 outbreaks.

The number of outbreaks of rinderpest reported from the settled areas is the lowest on record and the prevalence of the disease amongst farmers' stock is negligible.

Consequent on the extended use of rinderpest vaccine, the number of rinderpest double-inoculations carried out in settled areas and Native Reserves shows a reduction over previous years, and only 84,594 double-inoculations were undertaken in 1931 as compared with 137,299 in 1930.

Immunity tests showed an increase from 4,523 in 1930 to 6,647 in 1931, which is attributed to the demands of the natives in the East Suk Reserve, and serum alone inoculations increased to 584 in 1931 as compared with seventy-eight in 1930.

Farmers' Associations have been requested to consider the desirability of having their districts protected against the introduction of the actual virus as used in the double-inoculation method and it is hoped district associations will agree to the policy of gradual introduction of the vaccine method. The indications are, in the settled areas, that vaccination is being favoured since its introduction in early 1929, 5,307 courses of vaccine were issued that year as compared with 11,681 courses in 1930 and 28,020 in 1931. For years past the double-inoculation method has been employed in the Colony for combating rinderpest by conferring lifelong immunity, as a result the majority of adult cattle in the settled areas have been immunized, and the incidence of the disease is now negligible. It is quite evident that there is little hope of eradicating rinderpest completely in the settled areas by the voluntary double-inoculation method, as long as the disease prevails in Native Reserves and there is constant to and fro movement between them. In consequence a number of stock farmers will continue to favour a policy of active immunization and only extension of preventative measures to the contiguous Native Reserves can remove their prejudice. The double-inoculation method has served a very useful purpose in establishing confidence in disease control measures, but as a cattle producing Colony a step forward must be made and full consideration given to the possibility of eliminating the disease as better systems of farm management, fencing and control of squatter stock are now becoming evident.

A comparison of the advantages and disadvantages of the two methods results undoubtedly in favour of the vaccination method, and the present experience is that vaccination offers the best prospect of eradicating rinderpest, whereas the double-inoculation method may create new centres of infection.

Rinderpest Service.

During the latter half of the year the special rinderpest service was reduced from four to two units only, and in future the veterinary officer in charge of the district concerned will control the activities of this service instead of a special veterinary officer.

The rinderpest service undertook district double-inoculations in Nanyuki, including Laikipia, Nakuru and Lumbwa Districts, and in the East Suk, Baringo and Lumbwa Native Reserves. The following table gives the figures for inoculations carried out during the year and for comparison the figures for 1930 are appended :

DISTRICT	INOCULATIONS		Tests with Virulent Blood	Serum Alone
	Adults	Calves		
Nakuru ..	1,500	1,267	1,482	30
Nanyuki ..	5,883	3,923	141	240
Baringo.. ..	3,031	3,197	4,212	..
Lumbwa ..	10,052	6,365	53	6
TOTALS 1931 ..	20,466	14,752	5,888	276
1930 ..	39,804	16,039	884	..

EAST COAST FEVER.

The East Coast fever position as indicated over a period of five years shows a remarkably steady incidence, whereas the density of settlement and stock population has definitely increased. The position represents some advancement, although it must be considered in a general way, that all efforts towards administrative control have merely checked extension, and have made little progress towards the much-desired eradication.

The operation of the Fencing and Cleansing Ordinances would undoubtedly confer greater power and authority in the application of veterinary control measures, and would at the same time create in the minds of stockowners a greater confidence in ultimate success, and a sense of security likely to stimulate more general and uniform effort.

Extensive and exhaustive research is still required. Many factors concerning the spread and distribution of this disease require elucidation and it is satisfactory to record, as previously stated, that Dr. Cowdry, who visited this country a few years ago, is still pursuing investigations in America.

The following table gives the number of reported outbreaks in clean areas for the last five years: during the year provisional quarantines were imposed on thirty-five areas.

	1927	1928	1929	1930	1931
Northern Clean Area ..	37	38	28	28	68
Molo Clean Area ..	3	12	6	4	7
Limuru Clean Area ..	4	1	..	1	1

FOOT-AND-MOUTH DISEASE.

This disease is still prevalent throughout the Colony and mild outbreaks are reported from the settled areas and native reserves. A severe outbreak among high-grade stock was reported from one farm. This virulent form of the disease caused a heavy mortality amounting to ninety-two head out of a total of 514 and included twenty-four milch cows, sixteen heifers, eight steers, two bulls and forty-two calves. The milk supply dropped from about 300 gallons to nine gallons a day.

The infection was transmitted to the herds through the medium of transport oxen carting produce through the neighbouring infected Native Reserve.

A disturbing factor arises from the condition of the recovered stock, following an outbreak, as it is understood that cows are difficult to get in calf, the milk supply remains small, and many of the stock do not regain condition and are unthrifty.

The research officers are considering the possibility of producing some form of prophylaxis and are mapping out the types of the local viruses.

CONTAGIOUS BOVINE PLEURO-PNEUMONIA.

This disease is practically non-existent in the settled areas, a fact which must be attributed to the control exercised over the Native Reserves so infected, from which no cattle are allowed to move, except for slaughter purposes, under special conditions. Only one outbreak was reported during the year.

LYMPHANGITIS—ULCERATIVE AND EPIZOOTIC.

These diseases of equines also show a satisfactory decrease, especially ulcerative lymphangitis which is the more prevalent.

In the year 1927, forty-two outbreaks were recorded as compared with three outbreaks for the current year. No outbreaks of epizootic lymphangitis have been recorded. The causes of these decreases may be attributed to a better understanding of the diseases and better methods of stable management.

HORSE SICKNESS.

Horse sickness still continues to appear to some extent, although recorded outbreaks are level with the previous year.

A severe outbreak occurred in the Molo area in which serious mortality was experienced.

Research regarding vaccine production is still proceeding.

ANTHRAX AND BLACKQUARTER.

Blackquarter and anthrax outbreaks have increased considerably and these infectious diseases are chiefly reported from districts where there is an abundance of squatter stock which bring the infection from the adjoining Native Reserves.

BOVINE CONTAGIOUS ABORTION.

It would not be a true interpretation to assume that the large increase in the number of outbreaks of this disease, recorded for the year under review as compared with previous years, indicates that the disease is extending. The increase in recorded outbreaks is merely a favourable indication that much more attention is being devoted by stockowners to questions of abortion and sterility as they occur on the farm.

It is considered that the disease is widespread in this Colony, and that its control is a primary essential to successful farming, and particularly to the dairying industry.

MEASLES (*Cysticercus bovis*).

The carcases of approximately 13 per cent of slaughter cattle were condemned at the Nairobi Slaughter House during the year on account of *Cysticercus* infection and a somewhat similar percentage is condemned annually.

No less than 1,686 bovine carcasses were condemned at Nairobi abbatoir during the twelve months ending 31st December, 1931. This loss places a great burden on the industry and represents an enormous loss to the producer who has not available any form or scheme of insurance.

The *Cysticercus bovis* is the larval form of the human tapeworm, *Tænia saginata*, and develops in certain muscles, etc., of the bovine if the latter has access to food or water contaminated with human infected fæces. In a similar way, meat containing living parasites is consumed by the human, development of the tapeworm follows, with liberation of the eggs, to be consumed by cattle, and so the life-cycle of the parasite is maintained.

It thus follows that sanitation is an important consideration for the stock producer, not alone in his own interests, but also in the interest of public health generally.

If re-infection can be prevented by maintaining at least certain paddocks or areas uncontaminated, existing parasites *in situ* may die in the course of some months and material loss on slaughter is thus avoided.

RABIES.

Quarantine regulations imposing further restrictions on the importation of canines and felines have been revised and augmented during the year and the period of detention in quarantine was increased to six months. These quarantine regulations have caused owners to complain bitterly against the restrictions and additional expenses caused by the regulations, but from the point of view of the Colony, it will be acknowledged that the regulations are necessary for maintaining the safety of the public by such necessary precautions.

During the year an outbreak in dogs from the South Kavirondo Native Reserve was confirmed by biological test.

TRYPANOSOMIASIS.

Ten fresh outbreaks were reported during the year in the following districts:—Lumbwa, 2; Nairobi, 6; Nanyuki, 1; Eldoret. 1.

The incidence of this disease has decreased although there are probabilities of cases having escaped detection; no doubt the heavy rains of 1930 are responsible for the disease being now more manifest in certain districts, and the greater readiness to report suspected cases is in a great measure due to the results obtained in the treatment of affected cattle with tartar emetic solution.

Most of the infection is found among transport cattle since in the absence of tsetse fly and the coincidence that the disease occurs on precisely the same farms, the explanation may be that the infection is kept up by apparently recovered or treated cattle and spread by blood-sucking flies. Game is very sparse or absent in the infected areas and there is no definite information to show how the disease has been introduced by some outside source.

SHEEP SCAB.

Sheep scab continues to cause serious depreciation to flocks, and wool values. Many sheep farmers maintain that the disease as experienced in this country differs in respect of the life-cycle of the parasite, etc., owing to climatic and other conditions, and that methods for eradication successfully adopted in such countries as South Africa do not yield satisfactory results in Kenya. Research carried out by the Entomologist at the Kabete Veterinary Research Laboratory revealed that such is not the case, and that results obtained did not materially differ from those recorded in South Africa and also in the British Isles. During the course of these experiments it was observed that sheep experimentally infected with the parasite did not show marked clinical symptoms until three months had elapsed after infection. This is an important observation and is of great value to the sheep farmer when endeavouring to trace obscure sources of infection.

Home-made dipping fluids composed of lime and sulphur have been favourably reported on and are used on many farms.

STERILITY.

It is unfortunate that this condition has received little attention in this country, owing to the limitations imposed by staff provision.

Individual cases of sterility have come under observation from time to time, due to pathological conditions of the genital tract; but in certain instances herd sterility has been observed.

High grade or purebred cattle seem much more susceptible to the factors which influence herd sterility; this particularly applies to bulls, and in some outbreaks it was necessary to revert to mating by native bulls before a birth rate could again be established.

Further and special laboratory and field research into the subject of sterility in this country is urgently required. The full significance of the position as it affects the stock industry may be realized in so far as it has been estimated that the annual increase of cattle amounts approximately to 10 per cent of the cattle population.

DISEASES OF POULTRY.

The increasing importance of the poultry industry was not overlooked. Vaccines for the two major diseases, viz., fowl typhoid and fowl-pox were gazetted as a free issue. 27,432 doses of fowl typhoid vaccine and 5,267 doses of fowl-pox vaccine were issued. Diagnoses of poultry diseases are carried out at Kabete Laboratory free of charge.

A bulletin on Poultry Diseases was written at Kabete Laboratory and printed, copies of which are obtainable from the Government Press, Nairobi.

POISONOUS PLANTS.

Plant poisoning investigations were continued.

MISCELLANEOUS DISEASES.

Other diseases recorded but not in the form of serious outbreaks or epidemics are as follows:—

SHEEP—Sheep-pox; epizootic hepatitis (Waterloo sheep disease) Nairobi sheep disease; heartwater; endoparasites.

GOATS—Contagious pleuro-pneumonia of goats.

CATTLE—Anaplasmosis; piroplasmosis (redwater); streptothricosis; bacillary necrosis; contagious nodular vaginitis; calf paratyphoid; broncho-pneumonia; bacillary white diarrhœa; sweating sickness (calves); mineral and vegetable poisoning; heartwater; cysticercus bovis (measles in cattle); tuberculosis; mange; bovine lymphangitis.

HORSES—Biliary fever; mange.

PIGS—Swine fever; spirochætosis; cysticercus cellulosæ (measles in swine); osteomytitis; tuberculosis; parasitic infection (internal).

FOWLS—Kikuyu fowl disease; tuberculosis; fowl-pox; parasitic infections.

DOGS—Canine tick fever; distemper.

RETURNS FROM THE GOVERNMENT DIPPING STATIONS FOR THE LAST FOUR YEARS

STATION	EQUINES				CATTLE				SHEEP AND GOATS			
	1928	1929	1930	1931	1928	1929	1930	1931	1928	1929	1930	1931
Nakuru	36	..	1	41	6,974	13,404	1,993	1,826	15,442	26,997	24,518	29,570
Gilgil	2	1	..	20	9,048	9,765	4,049	6,107	..	..	1,245	..
Isiolo	121	98	112	134	921	..	..	..	80,085	55,515	70,295	69,851
Nanyuki	..	2	18	8	19,278	25,947	25,681	32,485	..	..	..	..
Rumuruti	..	..	..	..	1,400	3,115	1,980	4,831	..	..	1,879	384
Eldoret	21	16	..	..	..	771	1,414	739	706	..	..	..
Naivasha	..	..	..	..	..	..	15,256	10,892	..	..	15,631	15,935
TOTALS ..	180	117	131	203	37,621	53,002	50,373	56,880	96,233	82,512	113,568	115,640

N.B.—Total number of cattle dips in the Colony=330. Total number of sheep dips in the Colony=103.

During the year 486 dipping fluid samples were analysed by the Agricultural Chemist, free of charge and as a public service. An additional 54 samples were analysed on payment.

Stock Movements and Itinerant Traders.

At attempt was made to check the movement of native stock passing out of the Machakos Reserve during the year and figures of 5,301 cattle and 33,667 sheep and goats will give some indication of the movement and it is safe to state that the figures can be doubled by the number of stock moving without permission.

The itinerant traders are the cause of much trouble in the spread of stock diseases, as, in the absence of any definite marketing system in the Native Reserves, they move about buying and bartering stock in areas under quarantine restrictions and are in consequence a prominent reason for the enzootic nature of disease which has kept Native Reserves in perpetual quarantine for outward movement in the past. Constant complaints are received from the stock-farming community regarding the trespass of travelling stock on farm holdings and the accumulation of stock in township areas. In the absence of organized markets in the settled areas with a clear demarcation of stock routes, etc. it is difficult to visualize any control of these itinerant traders. Permits are requested for the movement of sheep for no definite destination but with the idea of selling when moving from farm to farm.

During the year thousands of sheep and goats were moved from the railway zone and neighbouring land between Kijabe and Nakuru, belonging to railway employees.

Stock on Townships.

The accumulation of Somali, Indian and native owned stock on townships still continues to cause anxiety, both from the point of view of disease control and the carrying capacity of the areas concerned.

For example : On the Gilgil township there were at the end of the year under review no less than 101 cattle, 212 sheep and seven equines.

On the Naivasha township, there were 178 cattle, 1,996 sheep and goats and eighteen donkeys, and on the Kitale township, 277 cattle.

Much of the time of the district veterinary staff is taken up with the control and inspection of this stock and the supervision of dipping operations.

During the previous year Government appointed a committee to inquire into the whole question of stock in relation to townships; meetings were held at various centres, but the inquiry is not yet complete.

Nairobi District.

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE IN THE NAIROBI DISTRICT DURING THE YEAR AND THE TWO PREVIOUS YEARS

Disease	1929	1930	1931
Rinderpest	45	13	3
East Coast Fever	..	9	1
Bovine Pleuro-pneumonia	1	..	..
Anthrax	8	4	3
Epizootic Lymphangitis	1	3	..
Ulcerative Lymphangitis	9	1	..
Horse Sickness	2	5	1
Swine Fever	..	..	1
Blackquarter	..	..	6
Trypanosomiasis	..	4	5
Foot and Mouth Disease	..	..	1
Equine Piroplasmosis	..	1	..

Rinderpest.—Only three outbreaks of rinderpest occurred during the year, this is in remarkable contrast to the number of outbreaks during the two preceding years. These outbreaks were controlled by quarantine measures, vaccine and anti-rinderpest serum.

East Coast Fever.—One outbreak only occurred in the clean area (Limuru) but this disease is still very prevalent in the enzootic areas of the district.

Trypanosomiasis.—Cases of trypanosomiasis were diagnosed on various farms in the Maragua and Punda Milia areas of the Thika district.

Horse Sickness.—The only case recorded died.

Anthrax and Blackquarter.—These diseases did not occur in outbreaks of a serious nature and were controlled by vaccination.

Other Diseases.—The larvæ of *Coraylobia anthrophaga* fly were observed in three dogs from the Hill district of Nairobi.

Nanyuki District.

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE IN NANYUKI DISTRICT DURING THE YEAR AND THE TWO PREVIOUS YEARS

Disease	1929	1930	1931
Rinderpest	4	10	6
East Coast Fever	17	10	12
Pleuro-pneumonia	2	1	2
Foot and Mouth Disease	..	36	5
Contagious Abortion	..	..	6
Trypanosomiasis	1	1	..
Heartwater	..	..	1
Nairobi Sheep Disease	..	..	1
Blackquarter	3	..	19
Horse Sickness	4	8	1

The Nanyuki Veterinary District includes the Laikipia Administrative District and embraces the settled portion of the northern clean area.

Rinderpest.—The simultaneous method (double-inoculation) of immunization against rinderpest was discontinued for the first time as a routine veterinary service and replaced to a great extent by the issue of rinderpest vaccine, when requested by stockowners. 5,042 doses of rinderpest vaccine were issued during the year.

East Coast Fever.—Several outbreaks of East Coast fever occurred almost all of which could be traced to some undesirable or illicit movement of cattle. These outbreaks however for the most part were quickly and effectively controlled by dipping.

Pleuro-pneumonia.—This disease still exists in the northern portion of the district and causes anxiety to neighbouring farmers.

Foot and Mouth Disease.—There were only five outbreaks of foot and mouth disease during the year, a considerable decrease from last year, but on one particular farm very heavy mortality was experienced even amongst adult cattle in addition to calves.

Contagious Abortion.—This disease is undoubtedly widespread throughout the district, but its exact incidence is unknown, as the disease rarely comes under observation unless a number of abortions have occurred.

Anthrax.—This disease did not come under notice during the year.

Blackquarter.—Nineteen outbreaks of blackquarter are reported, all of which were controlled by vaccination.

Sheep Scab and other parasitic infections of sheep were observed and require constant and particular attention.

Horse Sickness, Heartwater and Nairobi Sheep Disease have occurred without serious consequences.

Nakuru District.

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE DURING THE YEAR 1931 AND THE TWO PRECEDING YEARS

Disease	1929	1930	1931
Rinderpest	3	..	1
Pleuro-pneumonia	..	..	..
East Coast Fever	9	2	12
Trypanosomiasis	..	..	..
Blackquarter	1	6	17
Anthrax	5	1	15
Foot and Mouth Disease	4	..	6
Horse Sickness	..	2	1
Ulcerative Lymphangitis	..	..	1
Contagious Abortion	3	..	41
Avian Tuberculosis	..	..	1
Kikuyu Fowl Disease	..	..	4
Swine Fever	..	..	3
Redwater	..	..	18
Anaplasmosis	7	..	25
Paratyphoid	..	..	2

Rinderpest.—Only one outbreak of this disease came under notice on European-owned farms. This outbreak was controlled by serum and vaccine. 11,931 doses of rinderpest vaccine were issued.

A double-inoculation was carried out by the Rinderpest Service in the Lower Molo–Rongai area of approximately 1,258 adult cattle and 611 calves.

A double-inoculation was also carried out at Njoro and 1,740 vaccinated stock were tested for immunity, which is reported upon in the Chief Veterinary Research Officer's report.

Pleuro-pneumonia.—The district remained free from contagious bovine pleuro-pneumonia throughout the year.

East Coast Fever.—Twelve outbreaks of East Coast fever occurred in the clean areas of which eight occurred in Naivasha, two in Gilgil, one in Subukia and one in Elmenteita districts.

The Naivasha township remains free from disease.

Very few private dipping tanks have been constructed during the year, probably owing to the financial stringency.

Foot and Mouth Disease.—Six outbreaks of this disease occurred in the Njoro area, of a mild type with negligible mortality.

Anthrax.—Fifteen outbreaks of anthrax came under notice and were controlled by quarantines and vaccination.

Blackquarter.—Seventeen outbreaks of this disease were reported and resulted in considerable mortality.

Redwater.—Eighteen outbreaks of redwater came under notice. Serious mortality occurred in one instance, when cattle were moved from a farm on which dipping was regularly and carefully carried out, on to a farm where such practice was not observed.

Contagious Abortion.—Forty-one outbreaks of this disease came under notice.

Swine Fever.—Three outbreaks occurred with heavy mortality.

Other Diseases were observed, such as streptothricosis (bovines), bacillary necrosis, mange, spirochætosis, waterloo sheep disease (epizootic hepatitis).

Uasin Gishu and Trans Nzoia Districts, including Kitale.

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE IN THE ABOVE DISTRICTS DURING THE YEARS 1929, 1930 AND 1931

DISEASE	1929	1930	1931
Rinderpest	1	1	11
East Coast Fever	..	..	18
Anthrax	4	9	7
Blackquarter	9	64	59
Anaplasmosis	..	..	5
Piroplasmosis	..	..	2
Trypanosomasis	6	1	..
Ulcerative Lymphangitis	7	1	6
Foot and Mouth Disease	1	5	10
Horse Sickness	..	..	6
Kikuyu Fowl Disease	..	..	27
Contagious Abortion	..	..	1

Rinderpest.—Eleven outbreaks came under observation, all of which occurred amongst squatter cattle, chiefly on farms bordering on the Nandi Native Reserve. Susceptible cattle were collected and double-inoculated at the Baraton Station. Other outbreaks were dealt with by the vaccine method and 3,849 doses of vaccine were issued.

East Coast Fever.—The entire district is enzootic and reported outbreaks give no indication of the extent of the infection or mortality which has occurred.

There is now a definite tendency towards mixed or stock farming and the question of the eradication of East Coast fever will require more serious attention.

Anthrax.—Seven outbreaks of anthrax came under observation but it is considered that this number does not in any sense represent the incidence of the disease which is considered to be much more prevalent.

3,726 doses of anthrax vaccine were issued during the year.

Blackquarter—In a similar way, it is considered that the fifty-nine outbreaks of this disease do not represent the total amount of infection; on the contrary, there is reason to think that some thousands of cattle die annually from this disease, but since most of the cattle are native owned, it is impossible to arrive at a fairly accurate estimate.

8,317 doses of blackquarter vaccine were issued during the year.

Piroplasmosis.—Only two outbreaks were confirmed by smear examination at the district veterinary office.

Anaplasmosis.—Five cases were diagnosed.

Trypanosomiasis.—No fresh outbreaks came under observation in the settled areas.

The disease was, however, diagnosed amongst camels in Turkana (*T. brucei*) and caused heavy mortality.

A few cases were also observed in the Elgeyo–Marakwet Reserve.

Foot and Mouth Disease.—Six outbreaks were reported, all of which were of a mild type.

Horse Sickness.—Only six outbreaks were reported, but undoubtedly others occurred.

Twenty-nine doses of horse sickness vaccine were issued.

Kikuyu Fowl Disease.—Twenty-seven outbreaks were dealt with by vaccine. In two cases the vaccine issued was not effective, but a specially prepared vaccine gave good results.

Canine Tick Fever.—Fifteen cases were treated and twenty-three doses of canine trypanblau were issued.

Ulcerative Lymphangitis.—Several clinical cases came under observation and were destroyed.

Other Diseases were observed, such as contagious abortion. sheep scab and fowl-pox.

Lumbwa District.

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE DURING THE YEAR AND THE TWO PRECEDING YEARS

DISEASE	1929	1930	1931
Sheep and Goat-pox	1	..	..
Rinderpest	2	7	5
East Coast Fever	6	4	3
Trypanosomiasis	..	3	3
Pleuro-pneumonia	..	1	..
Contagious Abortion	..	2	2
Ulcerative Lymphangitis	5	3	..
Blackquarter	..	6	4
Heartwater	1	1	..
Horse Sickness	..	4	50
Anthrax	1	..	..

Rinderpest.—Of the five outbreaks of rinderpest which occurred during the year, four were amongst squatter cattle; the other outbreak occurred on a European-owned farm adjoining the reserve.

Double-inoculations have been carried out in the whole of the district, excepting Londiani, which favoured vaccination.

DETAILS OF RINDERPEST INOCULATIONS

DISTRICT	Adults	Calves	Tests	Total
Kericho-Sotik	1,521	1,054	..	2,575
Fort Ternan-Songhor ..	3,433	1,537	42	5,012
Lumbwa and Sotik ..	1,816	1,180	17	3,032
TOTAL ..	..	..	..	10,619

East Coast Fever.—Only three outbreaks occurred during the year and only ten farms or areas remain in quarantine at the end of the year.

Trypanosomiasis.—Three fresh outbreaks came under observation but without serious results.

Pleuro-pneumonia.—No outbreaks occurred during the year.

Contagious Abortion.—This disease was diagnosed on two farms.

Three-day Sickness.—This disease has been less evident this year. A few cases occurred in the Molo district.

Blackquarter.—On one farm only was this disease diagnosed. Several deaths occurred prior to investigation. All susceptible cattle were vaccinated and no further deaths have been reported.

Horse Sickness.—During the months of June to August, a serious epidemic occurred in the Molo district, and an isolated case in Lumbwa. During the three succeeding months a few cases occurred around Molo. The number of known or reported cases amounted to about fifty, but it is believed that the actual numbers were somewhat higher. Two vaccinated animals died and it is understood that in another case, death followed the administration of a course of three doses of vaccine plus virus.

Foot and Mouth Disease.—Two outbreaks occurred, with a mortality in one instance of 7 per cent and in the other instance no mortality was experienced. There was however an interval of ten months between these outbreaks.

Several cases of arsenical poisoning were diagnosed and a disease resembling what is known as Nairobi quarantine disease came under observation.

One thousand and fifteen transport oxen were vaccinated for contagious bovine pleuro-pneumonia.

Machakos District.

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE DURING THE YEARS 1929, 1930 AND 1931

Disease	1929	1930	1931
Rinderpest	..	..	5
Pleuro-pneumonia	..	1	..
Anthrax	..	..	1
Blackquarter	..	4	3
Horse Sickness	..	..	1

Rinderpest.—Four outbreaks occurred on European-owned farms, and were probably due to the illicit movement of squatter-owned stock.

1,680 head of cattle were double-inoculated with a mortality of approximately 1 per cent.

Pleuro-pneumonia.—There was no fresh outbreak of this disease during the year.

The quarantine remaining from last year was revoked.

Anthrax.—Only one outbreak occurred during the year, with a mortality of two animals. The outbreak was controlled by vaccination.

Blackquarter.—Two outbreaks occurred on European-owned farms and were controlled by vaccination.

Horse Sickness.—One case of horse sickness was reported.

Mombasa District.

The figures showing the importations during the year of purebred breeding and other stock are shown under the subdivision of animal husbandry.

Miscellaneous importations principally concerning an animal menagerie in transit were as follows :—

1 elephants, 1 zebra, 5 lions, 5 tigers, 1 leopard, 2 bears 1 monkey.

Importations also included :—

75 guinea pigs, 68 dogs, 7 cats, 2 rabbits.

Anthrax.—230 cattle were vaccinated for anthrax.

East Coast Fever.—This disease is prevalent on the Island.

Rinderpest.—Twenty-seven cattle were inoculated against rinderpest.

Trypanosomiasis.—This disease has caused mortality.

STOCK ARRIVING IN MOMBASA FROM UP-COUNTRY

	1928	1929	1930	1931
Cattle	450	479	548	786
Sheep	..	..	..	595

STOCK ARRIVING FROM THE NATIVE RESERVES OF THE MAINLAND BY ROAD

	1928	1929	1930	1931
Cattle	4,963	4,789	4,524	4,678
Sheep and Goats	22,733	23,894	24,014	22,927
Donkeys	69	42	40	13
Camels	..	..	..	2

HIDES AND SKINS INSPECTED FOR EXPORT

	1928	1929	1930	1931
Hides (bundles)	8,544	5,219	4,811	5,172
Skins (bundles)	3,184	2,912	1,959	410

Veterinary Quarantine Station, Nairobi.

Seventy-eight purebred imported cattle (bulls and heifers) were admitted during the year.

Nine animals were still under treatment at the close of the previous year, making a total of eighty-seven under treatment during the year under review.

Of this number nineteen remain under treatment.

The average period of detention for bovines based on an average of twenty animals actually immunized against redwater and anaplasmosis, is 204.7 days.

The average period elapsing between the inoculation with the first redwater and anaplasmosis vaccine and the onset of the reaction is forty-two days. Maximum, forty-eight days : Minimum, thirty-five days. The average period of the duration of the anaplasma contrale reaction was eleven days. Maximum, seventeen days : Minimum, eight days. The average period elapsing between the inoculation with the second redwater and anaplasmosis vaccine and the onset of the anaplasma marginale reaction was thirty-three days. Maximum, forty-three days : Minimum, twenty-seven days. The average period of duration of the anaplasma marginale reaction was fifteen days. Maximum, twenty-eight days : Minimum, seven days. Two animals recovered from redwater without treatment.

In one case a relapse to redwater after the anaplasma marginale reaction required a further inoculation with trypanblau.

One animal died, the cause could not be determined.

All imported bovines were subjected to the tuberculin test (intradermal). No reactions were observed.

On arrival at the quarantine station all cattle are vaccinated against rinderpest.

Five dogs were admitted during the year, one was discharged after the regulation period of six months, two were destroyed and two remained in quarantine at the end of the year.

Two cats were admitted and remained in quarantine at the end of the year.

One Bengal tiger was admitted and is still undergoing the period of quarantine.

BRANDING OF STOCK.

During the year the following brands were issued or otherwise dealt with :—

" S " brands supplied	24
Renewal brands supplied	12
Brands registered	76
Brands transferred	11
Brands cancelled	—

QUARANTINES.

The following particulars are furnished in respect of quarantines imposed and revoked during the year, settled areas and Native Reserves.

DISEASE	Imposed	Revoked	Remaining as at 31-12-1931
EAST COAST FEVER—			
Northern " Clean " Area ..	36	25	53
Molo " Clean " Area	6	5	14
Limuru " Clean " Area	1	2	2
RINDERPEST	32	33	15
Trypanosomiasis	12	12	16
E. A. Swine Fever	4	4	..
Rabies	3	1	3
Pleuro-pneumonia	5	5	12
Sheep-pox	1	2	..

STOCKOWNERS' CONSULTING COMMITTEE.

The Committee met once and reviewed the steps taken to implement the resolutions of the Stockowners' Conference held in September, 1930. From time to time the Committee was circularized for the purpose of ascertaining their views on current matters of importance.

Amongst the subjects considered were: Rinderpest immunization, the rinderpest service, sheep scab, foot and mouth disease, Nairobi quarantine station, movements of stock, railway rates on stock, wool and salt, and suggested amendments to the existing legislation regarding grass fires.

PERMIT SYSTEM.

During the year the following chanegs took place in the personnel of honorary issuers of permits :—

Remaining 31st December, 1930 ...	156
Remaining 31st December, 1931 ...	137
New appointments	22
Resignations	41

The resignations included the withdrawal of police officers from the list of honorary issuers of permits.

This opportunity is taken to record appreciation of the invaluable assistance rendered by these gentlemen not alone to the Department, but also to the stock trade in general.

(a) (ii) NATIVE AREAS AND RESERVES.

During the year the animal industry throughout all the pastoral native areas received an added impetus, necessitated by the greater need, owing to financial stringncy, for greater effort towards development.

CENSUS OF LIVE STOCK.

The most recent Agricultural census (1930) shows that the native-owned cattle population of this Colony is in the neighbourhood of 5,000,000 head and that the native sheep and goat population is approximately 7,000,000 head.

MARKETING OF CATTLE.

These figures clearly and forcibly indicate that, in any scheme for native advancement and for the advancement of the country generally, the native stock industry must play a prominent and important part.

Here is an industry waiting to be built up at comparatively small expense, by modern methods of disease control, marketing and animal management, into a greater expansion, with greater prosperity to the tribes and to the Colony.

With the exception of a comparatively small quantity of ghee, hides and skins, there is no export of animal products from the native areas.

There is a small export trade of cattle and sheep to Zanzibar via Lamu and an insignificant export of cattle to Uganda.

The Nairobi meat market, the largest market of the kind in the country, which consumes only about 14,000 head of cattle per annum, is partly supplied from the settled areas. The Mombasa market is mainly supplied by native stock with an absorption of about 5,000 cattle per annum.

These and other small beef requirements in addition to the small number of work oxen, heifers, etc., passed through the quarantine stations, constitute the only " draw " on the native cattle population. What becomes of the enormous remaining surplus over and above tribal food supply is difficult to understand and it can only be conjectured that the ravages of disease and drought conditions maintain the fairly constant equilibrium.

There is no export trade in meat from the Colony: as shown, the meat production is far greater than internal requirements demand. To the native a good animal is only as valuable as a bad one, when sold, only the lower price is obtained; under existing circumstances there can be no ambition.

MEAT PRODUCTS FACTORY.

A market accessible on the hoof and independent of minor restrictions must be found and in this respect a meat products factory seems to be the only definite and permanent solution.

The Masai Reserve, the Northern Frontier Province and most of the other principal pastoral areas could be linked up for the supply of a meat products factory, if such a factory were located somewhere convenient, perhaps on the Coast, with a view to an export trade, and the elimination of costly rail freight charges.

It is true that such a factory has been under Government consideration for some time and that application has been made for the necessary financial assistance from the Colonial Development Fund, but a sufficient grant could not be made owing to financial stringency.

It is, however, in this direction that a contribution to the development of the stock industry could be made, a development which would at once stimulate an interest and desire for disease control and better methods of animal management.

MARKETING OF SHEEP.

A far more satisfactory position exists regarding the internal marketing of native-owned sheep and goats. This trade is a flourishing one, the consumption approximates from 150,000 to 200,000 per annum.

The great sheep breeding areas of the Northern Frontier Province supply perhaps half of the number, the remainder is principally contributed from the Masai and Ukamba Provinces.

Sheep exported from the Northern Frontier Province are passed through Isiolo Quarantine Station where they are dipped and inspected before release. This trade is almost entirely conducted by the tribesmen themselves, in some instances by traders but frequently by the producers. The latter by way of encouragement are not required to take out stock trading licences.

It is interesting to note that the Kikuyu Province practically absorbs the entire Northern Frontier Province's export trade (sheep and goats) for purely native consumption.

STOCK DISEASE.

Before the native mind can reasonably be expected to concentrate on development, he must first be relieved of all serious anxiety concerning stock disease, an anxiety which is the inevitable result of experience and tradition.

Invasions of disease and consequent mortality have from time to time threatened his very existence, and have lead to tribal and inter-tribal disturbances. With these things he is concerned; they constitute custom, but their elimination would leave room for other considerations.

For the purpose of this report only the major diseases, rinderpest, East Coast fever, pleuro-pneumonia and trypanosomiasis will be discussed, since they alone influence the entire native cattle position, and are responsible for perpetual quarantine throughout all the native areas and reserves.

These diseases are endemic or prevalent in the Provinces as follows :—

Rinderpest.—Northern Frontier Province, Nyanza Province, Masai Province, Kikuyu Province, Rift Valley Province, Turkana Province, Nzoia Province.

East Coast Fever.—Kikuyu Province, Rift Valley Province, Ukamka Province, Masai Province (partly infected), Coast Province (partly infected), Nyanza Province (partly infected), Nzoia Province.

Pleuro-pneumonia.—Northern Frontier Province, Nyanza Province, Masai Province, Rift Valley Province, Turkana Province.

Trypanosomiasis.—Northern Frontier Province, Nyanza Province, Ukamba Province, Coast Province, Masai Province, Turkana Province, Rift Valley Province, Nzoia Province.

This distribution of disease, so widespread in its incidence, exemplifies to some extent the enormous problem which disease control presents to this Department: a problem complicated with overstocking of native grazing areas and intimately bound up with customs which breed suspicion of any modern methods of control likely to interfere with long-established practice.

Within the limitations of staff and other circumstances, attempts are being made to organize schemes for disease control and eradication, rather more of a basic nature, for future expansion, and also to deal with the more urgent requirements, as in the case of rinderpest and bovine pleuro-pneumonia control in the Masai Reserve, which is dealt with in detail under the heading of the Masai Province.

It is encouraging to record that demonstrations in stock disease control and animal husbandry have created favourable impressions and have stimulated increased desire for these activities, as instanced by the voluntary contributions from Local Native Councils, for these purposes, and further requests from the Nyanza and Coast Provinces for the establishment of centres for demonstration and instruction within these Provinces, or areas already allocated.

These requests must unfortunately be deferred until a more favourable time. With the staff and appropriations available it would be impossible to extend operations beyond the African Animal Husbandry Training Centres and native services already established.

African Animal Husbandry Training Centres have been iniatiated or are under construction as follows :—

Ngong, Masai Province.
Machakos, Ukamba Province.
Maseno, Nyanza Province.
Sangalo, Nyanza Province.
Isiolo, Northern Frontier Province.
Mariakani, Coast Province.
Baraton, Nzoia Province.

These centres are discussed in detail later, under provincial headings.

Each centre is or will be the headquarters of the provincial or district veterinary officer and a stock inspector or instructor in stock will assist him in the management of stock, etc.

A full curriculum of subjects has been arranged, covering a period of two years, and embracing various subjects, which are taught largely through practical demonstrations.

African animal husbandry training centres serve in addition as foundation stock farms and quarantine stations for the exit of stock under control from provinces or reserves.

All these activities are interrelated and dovetailed, so that concentration under one staff is not only desirable but is entirely necessary in the interests of economy.

Following on success already achieved and experience gained, a comprehensive scheme, providing for veterinary services and animal husbandry instruction, embracing all the native reserves and areas of the Colony, has been presented to and approved by Government.

It is hoped that it may be implemented as soon as possible, for there can be no doubt that the native stock population is potentially a most valuable asset to the Colony, an asset which has never been properly appraised, principally owing to the stock disease problem, bad methods of stock management and indifferent marketing facilities.

The scheme is a long-range one, extending over a number of years for completion, and aims at a definite and uniform policy for native stock conservation and animal husbandry, for the instruction of the tribes in the recognition of and control of animal disease, and, co-incidentally, to explore, in a comparative way, the economic capacity, i.e. breeding, milk yield, beef, etc., of all native types of cattle, and to co-ordinate results obtained, having due regard to climatic and other relative influences.

It may reasonably be anticipated, with the application of better methods of animal management and selective breeding, because the foundation material is excellent, that native types of cattle throughout the Colony will improve in conformation, and that the physical characteristics associated with milk production will be emphasized in succeeding generations.

In order to test out this hypothesis, and utilizing the herds already collected at the various African animal husbandry training centres typical of districts of origin, a brief preliminary survey was made by Mr. Gunn (Rowett Research Institute) and Mr. Anderson (Ngong).

HIDES AND SKINS.

In the hide and skin industry little advancement has been made during the year.

Depressed prices have shaken and disturbed the confidence of the native in all that he has learned from propaganda and departmental instruction.

Inducement was offered by certain merchants by way of a 40 per cent increase in the price of well-prepared and good-conditioned shade-dried hides, but little response was forthcoming, principally owing to the fact that, even with the premium, the price was so low that collection and transport charges left little in the nature of profit, and itinerant buyers rarely, if ever, grade hides as presented, but quote a price according to the lowest standard or grade.

The ruling price at present is from Sh. 14 to Sh. 20 per frasila (36 lb.) for the best grades, and a few cents for skins.

Attempts have been made to organize a marketing system by asking representatives of local firms to arrange for buying at a definite time and place, administrative and departmental officers having agreed to endeavour to induce natives to bring in hides, etc., but the scheme so far has not been successful.

Shade-dried hides are only obtained in any quantities in Nairobi, Mombasa and Kisumu. These supplies are entirely due to the large number of cattle slaughtered regularly, the hides of which are bought in the raw state directly or indirectly by the local firms, who arrange for better preparation and shade-drying.

Efforts were also made by departmental officers to stimulate the native in shade-drying methods, but unless the work of such officers is sustained by some system of permanent control, these efforts are wasted, because as soon as supervision and contact is withdrawn the zeal of the native immediately wanes.

Much time, care and energy have been devoted to the better preparation of hides during the past six years, but the success of the earlier years has not been maintained, on account of market depression, as the marketing system is unreliable and the prices of the commodities have dropped in value from Sh. 55 to about Sh. 18 per frasila as an average price for the higher grades.

Well-prepared hides are frequently placed in the lower grades owing to mutilation by brands. This mutilation is particularly the case with hides from the Masai Reserve and the Northern Frontier Province. Bad flaying, skin lesions caused by mange parasites, tick infestation and rinderpest are also factors which lower the grade.

During the year, rules under the Crop and Live Stock Ordinance were drafted making it an offence to plaster hides with mud or other material, and stipulating that shade-dried hides should be sold for cash only and within a radius of five miles, from a market provided with shade-drying facilities.

There is a difficulty in the application of the latter desirable condition, owing to the necessity of defining a market and the radius so required.

New shade-drying bandas have been erected in many parts of the native reserves.

It is realized that bad flaying of hides is a common practice, and an endeavour has been made to introduce wooden knives or safety knives, but without success, as the natives affirm these methods more laborious than their own. The chief difficulty is the removal of the hide in the recumbent position, which renders the proper method of flaying and stripping an impossibility. A circular letter, giving necessary instructions in proper flaying, was circulated among the officers engaged and interested in this work.

However, native interest in the better preparation of hides and skins is not completely lacking, since local native councils have voted small sums of money for propaganda work. This is encouraging, and efforts will be continued, as it is realized that enormous financial loss is caused each year by the export of an inferior product.

The quantity and value of exports of hides and skins for the last five years are shown below :—

YEAR	Hides	Value	Skins	Value
	Cwt.	£	No.	£
1931	35,000	63,628	942,285	37,269
1930	46,077	115,112	1,709,155	66,131
1929	64,369	263,804	1,502,203	74,052
1928	54,735	239,860	1,702,858	82,581
1927	47,834	163,096	1,164,520	61,625

It will be noticed that the export trade, both in volume and value of hides and skins, has considerably decreased as compared with previous years.

Financial provision has been made from the Native Trust Fund for expenditure on a series of experiments to investigate the causes or causes of " blister " in East African hides. The condition of " blister " is particularly prevalent in hides emanating from East Africa, and accounts for a loss of up to 25 per cent of the total received in England, and, in anticipation of the loss, causes a correspondingly low price to be paid for the raw product. The factors influencing the formation of " blister " are many, and in order to be in a better position to instruct the large number of individual producers a series of experiments, framed by the Veterinary Adviser to the Secretary of State for the Colonies, is being undertaken under controlled conditions, and the hides so prepared will be submitted to tanners in England for report.

GHEE.

Ghee is manufactured throughout all the native pastoral areas of the Colony, but the product as manufactured solely by the tribes themselves is of very low commercial value, owing to improper and faulty preparation.

It is the general custom to milk into native-made wooden gourds (*kibuyus*), slightly bottle-shaped in appearance, with a wide circumference and narrow stoppered neck. These utensils serve many domestic purposes, and may from time to time be cleaned with wood cinders or ash. The milk is at once tainted with a " smoky " smell, which clings to the butter afterwards produced by shaking the container. The butter is then allowed to remain in the same or a similar container for a long time before boiling, with the result that the ghee produced is tainted with an objectionable characteristic smell and taste.

It is the policy of this Department to endeavour to wean the native from this most uneconomic and wasteful practice, and to demonstrate that by methods of cleanliness ghee may be much enhanced in value. In this way, African animal husbandry training centres serve a useful purpose, by instruction and demonstration and by the provision of trained native personnel.

Field dairies have now been established in provinces as follows :—

Nyanza Province,
Masai Province,
Coast Province,
Northern Frontier Province.

These are furnished with modern equipment, which has been supplied in most instances from Local Native Council funds, and are under the direction of the Veterinary Department, except in the case of certain dairies in the Masai Province, which are directed by the Education Department.

The fall in the price of ghee has naturally affected the output. The native does not nor can he be expected to understand, at this stage, severe adverse fluctuation in the price of his marketable commodities. Industry outside his environment is not associated in his mind with his own immediate affairs.

The export of ghee shows a steady increase in quantity during the last five years :—

YEAR	Cwt.	Value
		£
1927..	116	786
1928..	121	1,004
1929..	534	4,478
1930..	793	4,929
1931..	990	3,810

The fall in value during the year is shown from the considerably lower value of the increased output.

It is not considered that an appreciable quantity of the ghee exported is produced by the native field dairies. This production is mostly absorbed by local consumption.

Ghee production is not encouraged except during or immediately after the rains, owing to the danger of malnutrition in children and calves by deprivation.

The price of ghee during the year was approximately :—

Good quality :	Sh. 24 per frasila (36 lb.).
Inferior quality :	Sh. 20 per frasila (36 lb.).

The zeal, patience and perseverance of the Administration is fully and freely acknowledged for the enormous amount of propaganda work carried out and the actual initiation of these dairies in many districts.

Large consignments of ghee are imported annually from India, commanding a very high price on the local market (Sh. 75 per frasila). This ghee is sought after by the better-class Indian community, but not perhaps on merit alone, since ghee produced at African animal husbandry centres, where strict cleanliness is observed during all stages of preparation, compares very favourably in quality. There is also an import trade from Tanganyika Territory, which sells at a lower price.

Owing to the increased output of ghee from widely distributed areas, and a desire for a uniform system of marketing to the best advantage, the appointment of a " selling agent " is under consideration.

PASTURE IMPROVEMEVT AND SOIL EROSION.

In certain native areas of the Colony, such as the Kamasia Reserve and parts of the Ukamba Province, overstocking and soil erosion have caused, more particularly during recent years, serious deterioration to grazing areas and destruction of natural fodder grasses or herbage.

Disease control and better methods of animal management are merely links in the chain of development, which become separated and inco-ordinated unless connected up with the provision of water and food supplies, sufficient in volume and nutrient content for animal requirements.

Natural pastures constitute the sole source of the native stock food supply, and it is obviously of great importance to investigate possibilities of improvement.

With this object in view, facilities have been provided at African animal husbandry training centres for experimental work connected with grassland investigation.

Two main lines of work have been undertaken by Mr. D. C. Edwards, Agricultural Officer—one to determine the effect of different intensities of stocking and also of grass-burning on the natural pasture, and the other to observe the behaviour under various climatic and soil conditions of indigenous species chosen as the result of experimental work at the Scott Laboratories. The former has as its objective the development of a system of management for natural pasture which will avoid the deterioration which has already occurred in considerable areas of Kenya as the result of overgrazing and general mismanagement, while the development of the latter will provide in the training centres convenient instruments in most of the representative grazing areas for determining the suitability to these areas of herbage species picked out as the result of critical experimental work elsewhere.

The bulk of practice in Kenya, even in European areas, consists of farming on ranching lines, where the natural pasture is relied upon throughout the year. Improvement of grassland under such conditions is not economical in practice. Under these conditions improvement can only be sought in the development of more rational management, such as some system of light rotational grazing in turn, and so gives the herbage plants a chance to re-establish themselves from seed. In this way, deterioration of the grazing by the supression of the useful species is, to some extent, avoided.

Further, it remains to determine the effects of grass fires. Although superficially it appears that burning is a practice to be discouraged, it may yet transpire that controlled periodical burning will play a part in the maintenance of large areas of grassland under ranching conditions.

The direction in which the greatest improvement of the food supply is possible is the development of comparatively small areas farmed by more intensive methods. Under such conditions manuring becomes an economic proposition, and more intensive methods of grazing are practicable. In limited areas the herbage and climatic conditions appear to be suited to these methods, but outside these areas in the greater part of the country re-seeding with chosen indigenous grasses will be a necessary part of the development.

With the above considerations in view, work is progressing on both natural pastures and the promising individual species, and it is hoped that this work will lead to definite progress in grassland management at no very distant date.

NYANZA PROVINCE.

The veterinary staff was maintained to the strength of the previous year, and in addition a veterinary officer was detailed for duty in the North Kavirondo Native Reserves and a stock inspector in the Lumbwa Native Reserve. It is regretted that no staff was available for the South Kavirondo Native Reserves.

General progress can be reported in the various activities, and the veterinary staff have worked hard and well under difficult conditions, and I wish to commend and acknowledge their work.

Active steps have been taken in disease control, but on account of the frequent visits of locusts and the consequent shortage of money a severe drop in the number of rinderpest inoculations has been caused.

The natives are very willing to have their stock immunized against rinderpest, but realizing that they are unable to pay the fees they are reluctantly obliged to risk loss from disease. Under normal conditions many thousands more cattle would have been voluntarily presented for immunization.

Rinderpest.

This disease was the chief cause of mortality amongst stock, and outbreaks were reported from every location. In the Central and North Kavirondo Reserves, 29,427 inoculations were carried out during the year, in comparison with 45,723 inoculations in 1930; a serious decrease is thus reported, which is chiefly due to a shortfall in the North Kavirondo Reserve. It is interesting to produce figures of the past four years to show how the voluntary inoculations of native cattle have been maintained until this year :—

	1928	1929	1930	1931
Maseno and Kibigori (Central Kavirondo Reserve)	19,222	40,218	30,820	25,770
Kitai and Bungoma (North Kavirondo Reserve)	16,513	7,808	14,903	3,657
TOTALS ..	35,735	48,026	45,723	29,427
GRAND TOTAL ..	158,911			

Contagious Bovine Pleuro-pneumonia.

This disease has been prevalent in the Central Kavirondo Native Reserve for some years, but attempts to detect it during the year have failed, in spite of inspections at butcheries and abattoirs.

A complete inspection of stock is about to be undertaken, with a view to revoking the restrictions on the movement of stock on account of this disease.

Tick-borne Disease.

The tick infestation is very severe, and it is estimated that 40 to 60 per cent of calves die from tick-borne disease.

In the native training centre at Maseno, in the Central Kavirondo Native Reserve, a cattle dip was erected during the year, and the successful results of dipping can be noticed already. It is hoped that the advantages derived from dipping stock from birth as demonstrated will be appreciated and copied by the natives in due course.

Trypanosomiasis.

A survey by the veterinary staff has proved the prevalence of *Glossina palpalis* and *pallidipes* along the banks of the Yala River and adjoining swamps through which this river runs to reach Lake Victoria. These flies are not usually noticed except when the thick bush is penetrated; this extends for ten to twenty yards on both banks of the river. It is noted that hippo, crocodiles, monkeys and water buck are plentiful in the river and swamps.

A wet smear examination showed that about 10 per cent of the cattle grazing in the vicinity of the river are infected with *T. congolense* and *vivax.*

Other infested areas were found in the locations bordering the Lake. At the request of the natives, the tartar emetic treatment was tried, and the native seems impressed by this mode of treatment, as 200 selected animals were presented and inoculated with fair results.

Unless bush clearing is undertaken, these areas will gradually become depleted of cattle, as the bush rapidly increases each year.

Blackquarter is enzootic in certain parts of the Province, especially along the Lake side, and every opportunity is taken to explain the advantages of vaccination, with the result the natives are using the protective vaccine more extensively.

Foot-and-mouth disease swept through the Province during the months of November and December. Fortunately, it was of a very mild type, causing insignificant mouth lesions but severe foot lesions.

Demodectic Mange and Streptothricosis is fairly prevalent and causes a much reduced value in the price of hides and skins.

Rabies was reported and diagnosed in a dog from Kisii, South Kavirondo Native Reserve, and steps were taken to round up all the pariahs in the locality.

Movement of Stock.

Permission was granted to farmers to purchase heifers in the Nyanza Province for the purpose of stocking up their farms, and approximately 3,000 were bought, at a price not exceeding Sh. 50 each.

Cattle in a constant stream are coming into the Nyanza Province from Tanganyika Territory, and are purchased on account of the low price, while there are more than sufficient Kavirondo cattle to supply all local requirements.

A large number of slaughter bullocks (1,937) was exported through Kisumu for Uganda, and transport bullocks in large numbers were bought in North Kavirondo for the farming community.

Permits for movement of 10,233 sheep and goats were issued by the stock inspector in charge of Kibigori Quarantine Station to proceed from the Central Kavirondo Native Reserve.

Kibigori Quarantine Station (Central Kavirondo) is the official outlet for the movement of stock from the Central Kavirondo Native Reserve; cattle are immunized and tested before permission is granted for movement into the settled areas.

During the year 7,224 rinderpest inoculations were undertaken, which included 4,110 Kavirondo native cattle, 953 Nandi native cattle, 1,983 trade cattle, 63 squatter native cattle, and 124 Government-owned cattle. 423 cattle were tested for East Coast fever immunity, and 857 cattle were vaccinated against bovine pleuro-pneumonia. The mortality from all causes was 237 head.

The revenue collected for these inoculations, etc., was Sh. 14,662-50.

Foot-and-mouth disease gained entrance into the quarantine station, and caused a slight mortality among the weaner stock.

Native poultry-houses were erected in the neighbouring Kano location, and three well-constructed poultry runs were finished in the Kibigori Quarantine Station, and started with a pen of pure-bred Australorps.

Hides and Skins.—Strenuous efforts were made to encourage all natives to shade-dry their green hides.

Thirty-five hide bandas have been erected in North and Central Kavirondo by this Department, and are regularly inspected. In locations where these bandas are situated the people are informed through their chiefs that all the hides must be brought to be shade-dried, and in consequence an increase in the output by at least 40 per cent can be reported; the hides from the Maragoli markets are of outstanding value.

Average price per frasila (36 lb.) throughout the year at Kisumu was Sh. 10 to Sh. 11, and 300 to 450 frasilas of shade-dried hides are exported monthly to Mombasa.

Central Kavirondo.

Ghee.—The production of ghee has made great strides in Central Kavirondo, as the production rose to 1,000 tins (four gallons), and including South Kavirondo to approximately 2,000 tins of 40 lb. each, at a price of Sh. 24 per frasila, as compared with Sh. 37 to Sh. 38 per frasila in 1930.

Eighty-five separators are operating in the Central Kavirondo Reserve, and a further fifty-one are available as opportunity permits. All the separators are under supervision, and a uniform quality of ghee is produced. Six field dairies were erected during the year, the cost of materials being found from Local Native Council funds.

Maseno African Animal Husbandry Training Centre.

Dairy Stock.—A number of Kisii heifers were purchased during the year, and were not added to the dairy herd until they had been immunized against rinderpest and tested for contagious abortion.

The dairy herd has thus been brought up to a total of 113 heifers.

Dipping of stock at five-day intervals commenced in June, and since that time an improvement in the health and growth of the calves and weaners is apparent.

The mortality recorded was four calves and seven heifers.

There are twenty-four calves; eleven females and thirteen males.

The average weight of the heifer calves at birth was 29 lb. and the bull calves 33 lb.

The average daily yield of all heifers during the first lactation was 4.1 lb.

The average daily yield of all cows during second lactation was 7.8 lb.

Development.—During the year progress was made in developing this centre, and it is now practically completed in regard to buildings and equipment.

A great deal of heavy sisal clearing was necessary to reclaim the land, afterwards ploughed and planted out with good pasture grasses.

Maize, buckwheat and lucerne were planted, and the crops fed to stock and poultry.

A tree nursery has been established, and is supervised by natives paid by Local Native Councils. Many young trees have been issued for planting out in the reserve.

A demonstration hide shed was erected.

About 40 tons of hay was cut and stacked for feed as required.

Poultry.—Better methods of poultry husbandry were demonstrated throughout the year, and a number of pullets and cockerels were raised and issued when mature to responsible natives in adjoining districts, who caponized their own native male birds before receiving the pure-bred cockerels.

Each location in Central Kavirondo has now a demonstration poultry house, provided from Local Native Council funds.

Natives are being encouraged to export eggs to the larger centres of the Colony.

The Local Native Council, Central Kavirondo, have voted £240 for the purchase of pure-bred cockerels and pullets during 1932, and it is hoped that over one thousand birds will be supplied.

Disease amongst the poultry was unfortunately prevalent, particularly ophthalmic roup and internal parasitic infections. Very little difficulty was experienced in raising chickens to the age of two months; after this age disease became most prevalent, with heavy mortality.

All the stock is regularly immunized against Kikuyu fowl disease.

Rhode Island Red and Australorps are the breeds established; the former has proved more resistant to disease, and more suited to the conditions in Central Kavirondo.

Some four hundred fowls were distributed during the years.

Pupils.—Eleven pupils were transferred to Maseno from Ngong during the year.

The centre was visited by many tribesmen, who are exhibiting a keen interest in the work being done.

General demonstrations were arranged when such people as headmen, village school teachers, and Jeanes school teachers visited the centre.

Arrangements were made for the masters of the Maseno Central School to bring their classes two or three mornings every week to see the milking and self-feeding, etc.

Rainfall: 61.14 inches.

Kisiani Dairy.

This dairy remains under the supervision of the veterinary staff. 8,521 gallons of milk were received during the year, or an average of 23 gallons per day, as compared with 29 gallons per day during the previous year and 24 gallons per day during 1929. The average cost of milk was 32 cents per gallon and the total cost Sh. 2,733/39. The total income to the Local Native Council for the ghee produced—3,000 lb.—was Sh. 2,834/88. The milk supply was at its lowest in May and June (wet months), and at its highest in the driest month, January.

Sangalo African Animal Husbandry Training Centre (North Kavirondo Native Reserve).

Stock.—The breeding herd now consists of 76 cows or heifers and one bull.

Twenty-seven calves were born during the year, the average weight at birth being 34 lb. Fifteen deaths occurred from East Coast fever. All calves were hand reared.

Poultry.—The foundation flock of fowls consisted of four pens of Rhode Island Reds. Hatching was, however, limited, as it was found that although the natives wanted to purchase poultry the money to do so was not available.

During the year a small egg circle was started, with the object of teaching the benefit of marketing large clean and fresh eggs.

Eggs were collected at irregular periods, boxed and marketed, thereby increasing the price obtained from one to four cents per egg.

Development.—About 160 acres of the centre area have been cleared. Ten acres of maize was grown for silage, a pit made, and the maize put down. One acre of buckwheat gave fair results, and one acre of lucerne yielded three cuttings. The planting of clover was not a success. Some hay was made. About thirty acres has been stumped and broken, and is almost ready for the next planting season. Three hundred and twenty acres are now completely fenced; about half the area of the centre.

From the station nursery about 20,000 tree plants were issued to the reserve.

Surface water drainage has been extensively carried out.

LUMBWA RESERVE.

A stock inspector has been stationed at Kericho, who worked under the direction of the Veterinary Officer, Lumbwa (settled area).

Rinderpest inoculations were carried out during the year; 5,328 head of cattle were inoculated. Vaccinations were also carried out for contagious bovine pleuro-pneumonia.

A hide shade-drying shed has been erected, and demonstrations given in relation to quality and price.

The establishment of an African Animal Husbandry Training Centre is under consideration, land for which has already been earmarked.

MASAI PROVINCE.

The veterinary officer in charge of the Ngong African Animal Husbandry Training Centre acted in an advisory capacity to the Administration until it was found possible to place a veterinary officer and two stock inspectors in the Reserve for a scheme of rinderpest eradication, in addition to the staff at Ngong, consisting of one veterinary officer and one stock instructor.

This scheme was initiated following on discussions at a meeting of the veterinary representatives of Tanganyika, Uganda and Kenya, in the direction of a common policy for the eradication of rinderpest on inter-territorial boundaries (referred to under the heading of " Rinderpest " in the introductory part of this report).

The main feature of the programme accepted was that virulent material should not be used in the process of immunization. This involved a departure from the policy of active immunization hitherto practised in the native areas of the Colony.

The principle outlined was the rapid suppression of all centres of infection, employing vaccine (inactivated) and serum on infected herds and vaccine (inactivated) alone on in-contact herds, thereby enclosing the focus of infection within a ring of temporarily immune (vaccinated) cattle, with the further measures of quarantine and control of movement.

As may be observed in other parts of this report, inactivated rinderpest vaccine, prepared and issued by the laboratory, has been extensively used in the settled areas, the dosage consisting of a course of three inoculations of 10 c.c. of vaccine at weekly intervals. It was at once obvious that, in a campaign of the kind under consideration, vaccine could not be conveniently and economically supplied by and transported from the laboratory, and that one inoculation only was much more practicable and convenient when dealing with native nomadic herds.

Preliminary investigations had therefore to be carried out in regard to the field preparation and dosage of vaccine and serum. This work was carried out at the Veterinary Research Laboratory, Kabete, and in the field. The general scheme of organization and direction of operations was entrusted to the Acting Assistant Chief Veterinary Officer, and the application, with modifications as necessary, to a veterinary officer posted to the Masai Reserve.

A native staff of scouts was acquired, trained and distributed throughout the area of operations for intelligence purposes regarding disease and to make a stock census.

The application of the scheme and technique observed may be of some interest, and is briefly embodied as follows in an excerpt from the Veterinary Officer's report :—

> " Commencing at Loitokitok in May, 1931, the scope of operations has been gradually extended in a northerly and westerly direction, and at the end of the year the whole of the Kajiado district south of the Magadi Railway is

included in the area under control. The remaining small portion of the Kajiado district across the railway will be brought under control at an early date.

" A steady and general decline in the incidence of rinderpest has illustrated the efficacy of the methods adopted. During July and August, infection was widespread among the Mattubattu and Purko sections of the Masai, but as a result of active measures being undertaken there are now only two known centres of infection in the area under supervision. In the Loitokitok area, the rapid suppression of an outbreak of rinderpest in June, 1931, prevented any extension of infection in that area, and the entire district has since been free from disease.

" In establishing this control of rinderpest in the Kajiado district it was necessary to resort to inoculation and quarantine in twenty-three bomas. Owing to the annual occurrence of rinderpest in previous years, nearly seventy per cent of the 21,000 cattle were inoculated, and of the 5,782 head which received vaccine, 1,318 head, being exposed to immediate infection by contact, received in addition a single protective dose of anti-rinderpest serum, averaging 25 c.c. In some cases it was found that rinderpest had almost run its course in certain bomas, and in these it was not advisable to inoculate. Quarantine restrictions were enforced, however, and a further 18 bomas, with a cattle population of nearly 19,000 head, were dealt with in this manner.

" An organization has been built up to allow of regular weekly inspections of all cattle, and approximately 25,000 head are now under supervision by a staff of 28 native scouts. With this reliable system of intelligence in operation it is confidently anticipated that it will be possible to undertake active measures within ten days of the appearance of rinderpest in any herd. It is therefore considered unlikely that any serious " backfire " will occure, while it should be possible to avoid any extension of infection from the present centres.

" All the vaccine used has been prepared under field conditions at the scene of the outbreak, the owners submitting two per cent of their susceptible cattle for this purpose, the carcass and hide being returned to the original owner after removal of the spleen, precautions against the spread of infection being taken. The method of preparation of the inactivated rinderpest spleen vaccine has been as follows :—

" After infection of the selected vaccine makers with citrated virulent blood obtained from sick animals at the scene of the outbreak, temperatures are taken daily, and the animals killed when reacting strongly to rinderpest. The spleens are removed in a sterile manner, minced, and weighed after mincing. To each part by weight of spleen pulp is then added four-tenths of a part of nine per cent saline, with the object of rupturing the spleen cells and liberating the virus. After twenty-four hours the concentration of saline is reduced to normal by the addition of 3.6 parts of boiled water, which gives a final dilution of one part of spleen pulp to four parts of normal saline. This constitutes the vaccine, which is then strained through muslin before being inactivated by the addition of three parts per thousand of commercial formalin (40 per cent formaldehyde). After forty-eight hours' exposure to the action of the formalin, the vaccine is ready for use in doses of from 25 c.c. to 40 c.c., according to the size of the animal.

" In the absence of storage facilities, no vaccine which has been kept for more than five days after preparation is used.

Anti-rinderpest serum has also been prepared in the field by bleeding recently recovered animals supplied by the Masai, enough blood being withdrawn to replace the amount of serum used.

" While considerable opposition from the Masai was encountered in the early stages of the campaign, their present attitude is encouraging, and it is now usual for requests for vaccination to be made by the Masai themselves."

It will thus be seen that, in addition to the activities at Ngong Veterinary Centre, veterinary services in the Masai Reserve were mainly concerned with rinderpest eradication. Coincidentally, however, with this work a general stock disease survey is proceeding, particularly in regard to contagious pleuro-pnemonia, anthrax and blackquarter, together with the collection of data for a detailed cattle census.

African Animal Husbandry Training Centre, Ngong.

Staff consists of one veterinary officer and one stock instructor.

Pupils.—Instruction was carried out on similar lines to 1930.

Owing to reorganization of the centre, pupils other than Masai were drafted back to the various training centres in the respective reserves during the month of June.

In December, the school was reopened. The pupils are entirely Masai, with the exception of two Kisii boys.

Twenty pupils were resident at the end of the year.

Poultry.—Poultry was introduced during the year, but owing to housing being inadequate were subsequently transferred to Machakos centre.

Disease.—On account of a serious outbreak of contagious abortion, the work previously accomplished in selection of native cows has suffered a severe setback. Owing to sterility, subsequent to abortion infection, numbers of cows which showed great promise during the first and second lactations had to be cast from the herd.

East Coast Fever.—Eight cases occurred amongst cattle sent from Kabete Laboratory for grazing.

Stock.—The total breeding herd consists of 111 head of Masai, Boran and Machakos cows and heifer, and the instructional herd, 137 mixed grade and native cows.

Sheep.—A small flock of Masai and Samburu ewes, with a Masai ram, are run at the station.

The ewes are thriving, and have all lambed down. It is hoped to rear rams for sale to the Masai.

Cultivation.

1. *Lucerne.*—Half an acre has been established, which yields several excellent crops annually.

In view of the above results, a further six acres have been sown during the last rains.

2. *Maize.*—Several acres were planted during the March rains, but owing to the advent of locusts were cut green and stored as stack silage. This has not proved a success.

3. *Subterranean Clover.*—Proved a failure, and has been ploughed in.

4. *Hay.*—Several stacks of excellent hay have been secured during the year, thus making provision for feeding of stock should the grazing have been eaten by locusts or suffered from drought.

Fencing.—The forest boundary fence has been cut in several places by natives, but unfortunately they have escaped detection. Along a considerable part of the boundary fence kei-apple and Mauritius thorn has been planted. Both types of plant are doing well.

Water.

(*a*) *Borehole and windmill.*—The supply from this source continues to be satisfactory.

(*b*) *Ram installed in Mbagathi River.*—The ram has given trouble continuously, in spite of the fact that numerous experts have carried out repairs on it.

Rainfall.—Total, 35.475 inches. This shows a decrease of 8.735 inches on 1930.

Dipping.—Dipping of all stock on farm is carried out at five-day intervals. Several local Masai avail themselves of the facilities provided for dipping their cattle at the station.

Hides.—Flaying and shade-drying is being carried on as in previous years.

Dairy Produce.

Milk : 7,384 gallons were separated.

Cream : 7,111 lb. of cream made into butter.

Butter : 4,041 lb. of butter made into ghee.

Ghee : 2,988¼ lb.

Ghee was sold and realized from Sh. 31 to Sh. 35 per tin.

Movement of Stock.—10,202 head of slaughter stock were permitted to move under escort to Nairobi, after inspection from the Masai Reserve.

Revenue Collected from the Centre.—Sale of ghee and stock : Sh. 6,757/72.

UKAMBA PROVINCE.

The normal staff is one veterinary officer, who devotes part of his time to settled areas, and one stock inspector in charge of the Machakos African Animal Husbandry Training Centre.

Two extra stock inspectors are at present arranging for rinderpest immunization (double inoculation) in the Machakos Reserve.

Stock Disease.

Rinderpest has not been recorded in the Machakos Reserve for nearly two years, but the natives have requested double inoculation. One outbreak occurred in the Kitui Reserve during the year.

Pleuro-pneumonia is also non-existent in the Province.

Anthrax.—One outbreak occurred in the quarantine reserve.

Blackquarter.—Three outbreaks were reported in the Machakos Reserve.

Goat Scab is enzootic in the Kitui Reserve, and results in constant reinfection of the natives herding the flocks, usually children. With the assistance of the Kitui Local Native Council, it is hoped to commence dipping of the flocks as a means of control.

An attempt has been made to check the movement of stock from the Machakos Reserve. The figures of 5,301 cattle and 33,667 sheep and goats which have moved during the year will give some indication of the movement, but it is likely that these figures are actually doubled by unauthorized movements.

The question of the railway mile zone remains unsettled, and is a source of constant friction.

Attention has frequently been drawn in the Annual Reports of this Department to the unsatisfactory condition of certain areas of the Machakos Reserve, from the point of view of soil erosion and destruction of natural pastures by overstocking.

Reconditioning or any attempts at amelioration have not yet been attempted.

The cattle population of the Machakos Reserve has been estimated at 250,000 head, and the sheep and goat population at 300,000 head.

Machakos Quarantine Station.

The figures for inoculations, tests, etc., are as follows :—

Double inoculations	4,428 head.
Serum alone (anti-rinderpest) ...	728 head.
Rinderpest vaccinations	167 head.
East Coast fever tests	397 head.

Machakos African Animal Husbandry Training Centre.

The breeding herd consists of 88 cows and three bulls.

Forty-six cows calved during the year, and completed their lactations.

Milk Records.—The highest yield was 975 lb. of milk over 172 days. Four cows gave no milk at all. The figures for ten cows which calved during 1930 and completed lactation in 1931 are as follows: Average number of days lactation, 198; yield of milk, 662 lb. The highest yield was 1,447 lb. over a period of 243 days. The lowest yield was 71¾ over 63 days. Twenty-two cows which calved during 1931 are extending their lactation period into 1932.

Calves.—Bull calves, with a few exceptions, have been killed at birth, on account of the small quantity of milk available for feeding purposes. Only twenty-one calves, mostly female, remain at the end of the year.

Disease.—Contagious abortion has been eradicated, but East Coast fever is endemic, and causes much mortality amongst the calves.

Poultry.—In the latter part of the year, 62 Australorps and Rhode Island Red fowls were received from Ngong to establish a poultry station at Machakos for the benefit of the natives of the Machakos Reserve, who ordinarily keep fowls. In addition, 28 birds were received from Naivasha, bringing the number up to 90. Eighty-seven chickens remained at the end of the year. There is at present no disease amongst the poultry.

Development.—Dairies and calf-houses were constructed and re-arranged. Three poultry houses were erected, a considerable number of small hatching boxes were made, and wired-in pens and chicken runs have been arranged and now cover an area of about 2½ acres.

Five small plots were fenced for experimental work on grasses and pasture problems by the Agricultural Department. Maize and beans were also planted for food supplies. Areas have been cleared and stumped in preparation for hay crops. A number of trees have been planted out, and an extensive nursery is maintained to pursue this work.

Pupils.—Pupils have not yet been accepted at this station.

NZOIA PROVINCE.

Veterinary services for the native areas of this Province have not extended beyond the Nandi Reserve, for which Baraton is the African Animal Husbandry Centre.

Baraton Centre.

Staff.—This station is under the immediate charge of a stock inspector, and is directed by the Veterinary Officer, Eldoret (settled areas).

Breeding Herd.—The foundation herd of breeding cows and heifers was increased from 32 cows last year to 58 head at the end of the year under review. All animals susceptible to rinderpest were vaccinated.

Calves.—Twenty-eight calves were born during the year. The average weight at birth was 41 lb., ranging between 25 and 57 lb., and the average daily increase was at the rate of .63 lb. per day, with a range of .40 to .86 per day. Weights are recorded at fortnightly intervals.

Milk surplus to feeding requirements is converted into butter and ghee, the proceeds from the sale of which amounted to Sh. 424/80.

Development.—A water supply has been installed with funds provided by the Nandi Local Native Council at a cost of £500. This generous contribution indicates the interest which is taken by the natives themselves in work of this kind. Fencing has been expedited with a view to the improvement of pastures by rotational grazing. Native quarters have been built, the cattle byres extended, improvements made to the cattle dip, a shade-drying banda erected, and extensive clearing of the grazing areas carried out.

Pupils have not yet been received at this station.

Rinderpest Inoculation.—During the year 12,585 cattle were immunized against rinderpest by the staff of the Baraton Centre in the Nandi Reserve.

RIFT VALLEY PROVINCE.

There is no whole time veterinary staff for the native areas of this Province.

During the year 6,000 cattle were immunized against rinderpest (double inoculated) by the Rinderpest Service in the Suk Reserve.

KIKUYU AND TURKANA PROVINCES.

It has not yet been possible to place a permanent staff in either of these Provinces. They are merely visited as occasion arises by the nearest veterinary officer.

COAST PROVINCE.

During the year the veterinary staff stationed in the Coast Province, under the capable supervision of the Veterinary Inspector, has worked satisfactorily, and the services which were commenced during the previous year are in a more organized state.

The greatest thanks are due to the Provincial Commissioner and his staff for the great assistance they have freely given in promoting the activities of the veterinary services.

Rinderpest.—As the result of infected cattle arriving in the Lamu district from the Northern Frontier Province, an extensive outbreak of rinderpest was reported and generally spread throughout the district, including Lamu Island. In the absence of suitable virus, extensive anti-rinderpest serum inoculations were performed around the foci of the disease and on Lamu Island.

Double inoculations were eventually carried out, which included stock in the neighbouring district of Kipini. 2,151 cattle and 772 calves were serumized, and 1,988 cattle and 1,449 calves were double inoculated. The mortality for the natural outbreak was very severe, which is reflected in the reduced stock census figure of the district.

Trypanosomiasis.—Reference is made to this disease under the veterinary surveys of the different districts. On Mombasa Island, *T. congolense* infection is rife among the dairy stock, but treatment with five doses of a 4 per cent antimony tartrate solution, injected intravenously in 30 to 40 c.c. doses every fourth day, has proved a successful treatment. Old goats were found to be infected with the *congolense* type.

Many suggestions have been made to the natives to help and assist in dealing with the tsetse fly menace, such as bush-clearing, etc., but the progress in this respect is very slow, as most of the natives are lethargic and suffer from the effects of malaria, etc.

Movement of Stock.—6,535 cattle and 26,404 sheep and goats were drawn from the different districts, including Kitui, for the purpose of local meat supply at Mombasa and elsewhere, and passed through the Mariakani Quarantine Station.

Makowe Quarantine Station, Lamu.

More facilities were added to this quarantine station, such as a permanent hut for the veterinary assistant, cement water-trough, temporary office, three native huts, and three water-wells were dug, one of which was cemented and made permanent, during the year. The quarantine was shut down during six months of the year on account of the outbreak of rinderpest.

The following cattle were received and passed out: Cattle, 1,937; sheep and goats, 7,724.

The numbers of live stock exported to Zanzibar via Lamu were: Cattle, 131; sheep and goats, 3,751. The number passed overland to Mombasa was: Cattle, 544; sheep and goats, 608.

Dairies and Ghee.—One field dairy was established in the Lamu district, but the outbreak of rinderpest caused a marked decrease of the milk yield. Five field dairies are established in the Kilifi district and one in the Kwale district. During the year 1,300 lb. of ghee were made and sold at a price between 70 cts. and Sh. 1/20 per lb. Towards the end of the year the dairies became idle, as the drop in the price of ghee would not allow a good price for milk, and consequently the supplies of milk were suspended.

Mariakani African Animal Husbandry Training Centre.

In conjunction with the neighbouring quarantine station, a training centre was established at Mariakani on a very small scale. Fifty acres of land were fenced in and temporary cowsheds erected to house six heifers purchased locally.

This area was cleared of bush and planted with grass after ploughing.

It is yet too early to report to any extent on this demonstration centre.

The Local Native Councils are desirous of establishing a large demonstration centre and arrangements are in hand to acquire the necessary land at Gothani.

Stock Survey.

During the year a veterinary survey of certain districts in the Province was made.

In the Digo District the total number of stock amounted to 1,522,336 head, which included 104,659 sheep and goats, 21,097 cows, including heifers in calf, 21,436 calves, 2,901 bulls and 2,243 oxen. This census may be taken as accurate. More than half the area of the Digo district, approximately 3,207 square miles, is unsuitable for cattle owing to the prevalence of tsetse fly, but encroachment into these fly areas occurs during the dry seasons when cattle are in search of grass and water, resulting in a certain amount of infection and serious mortality during a heavy rainy season. Sheep and goats apparently thrive well in these areas, where cattle cannot live.

In this district, indeed throughout the Coast belt, tick-borne disease is very prevalent.

In the Lamu District, area 2,430 square miles, the census of stcok was 12,344 head, including 8,439 cattle and 3,903 sheep and goats. The number of stock in this district is most disappointing and the diminished numbers are due to the outbreak of rinderpest in 1930, at Hidio, and severe outbreaks of tranpanosomiasis at Didvereza. Some parts of the district have excellent grazing, surrounded by fly belts and thick bush, but it is apparent that the bush is gradually encroaching on these grazing areas.

Large herds of goats are evidently doing well in fly-infected districts.

With the clearing and burning of bush this district offers great potentialities for stock-rearing for which in the days gone by the district was famous.

Taveta Native Reserve.—The survey of the Tavetä Native Reserve showed that most of this reserve is infested with tsetse fly with a few isolated free patches. The incidence of fly is evident from the number of sick anmials and in spite of annual mortality the increase in the number of stock indicates that the natives can be successful in evading fly belts, assisted by a peculiar system of husbandry in that the better cattle are kept in huts and hand fed.

The number of stock in this Native Reserve is 12,568 head including 2,100 cows, 705 calves, 7,217 bulls and 9,036 sheep and goats.

Kilifi District veterinary survey was completed with the exception of Rabai and a part of the Gothani district; this district is generally fly-infected, as in the other districts of the Coast Province, many open spaces free of fly are to be found.

The stock census of this district is 108,342 head, including 38,472 cattle and 69,890 sheep and goats.

The stock census of the Coast Province has not been completed as several districts, including the Tana River and Teita, are yet to be included in final figures which should approximate over 400,000 head of cattle.

NORTHERN FRONTIER PROVINCE.

The staff of the Northern Frontier Veterinary Services consisted of one veterinary officer and two stock inspectors. The duties of the veterinary officer were of an advisory nature to the Provincial Commissioner in respect of stock disease and animal industry. One stock inspector devoted all his time and attention to the African Animal Husbandry Training Centre, in addition to his supervision duties at Isiolo Quarantine Station. The other stock inspector was mainly concerned with the establishment and supervision of Laisamis Sheep Breeding Station.

Area.—The estimated area of the Northern Frontier Province is 95,000 square miles, or nearly 61,000,000 acres. This vast area is almost entirely pastoral with only small patches of arable land, widely distributed. In many places there is a dense growth of bush, and for the most part the soil is sandy and arid.

Human Population.—The human population of the Province has been estimated in the neighbourhood of 70,000 thus showing considerably less than one human being to very square mile or 640 acres.

Stock Population.—It is estimated that the cattle population does not exceed 300,000 head. This estimate is in no sense based on fact, but merely on observation.

The sheep and goat population is, in relation, very much greater, and is probably in the neighbourhood of a few million head.

The camel population is entirely unknown as no export of camels or camel products exists, and there is therefore no basis on which the population can, at present, be estimated.

It will thus be seen that there is a vast discrepancy between the human and stock populations on the one hand and what might be considered as the normal carrying capacity, per square mile, or per acre, of a pastoral area; but this discrepancy can, to a great extent, be explained by the shortage of water, the presence of major disease, tsetse fly, density of bush, low and uncertain rainfall and general climatic conditions.

Isiolo District.

The Isiolo district includes Samburu which is the main cattle-producing area of the Province. The cattle population has been definitely estimated in the region of 130,000 head.

Rinderpest and contagious bovine pleuro-pneumonia are endemic, but serious mortality has not been experienced during the year.

Tsetse fly is prevalent, particularly along water courses and throughout the course of the Uaso Nyiro River. A highly infested belt exists on the Isiolo–Garba Tulla Road some fifteen to twenty miles west of Garba Tulla. Many specimens of tsetse fly have been collected from this area.

Contagious pleuro-pneumonia of goats has been observed. This disease causes very high mortality, its etiology is unknown. Research work is, however, being carried out at the Veterinary Laboratory, Kabete.

There is a steady, but limited, trade in sheep and goats, ghee and hides to markets outside the Province; and a small number of cattle, after undergoing quarantine at Isiolo, have been exported to Meru for slaughter.

Two further ghee dairies, making three units in all, have been established by the Administration, but the output of ghee has unfortunately been curtailed by destruction of grazing due to locusts combined with drought conditions. The ghee produced commands a low market value owing to taint from the milk containers (*kibuyu*).

A red type of sheep is found throughout this area but more particularly on the Leroki Plateau. This type is known as the Samburu sheep as distinct from the blackfaced Persian type of the lower altitudes. Sheep-breeding is however a secondary consideration amongst the Samburu, who are now at least particularly a cattle-owning tribe and more interested in cattle production.

A colony of Somalis and their stock occupies part of the Isiolo area and an area south of the bend of the Uaso Nyiro River.

Tribal transport is mainly carried out by donkeys and occasionally by camels.

Four tribesmen from Samburu area have been received as pupils at the African Animal Husbandry Training Centre, for instruction in stock disease and animal husbandry.

Marsabit District.

The Marsabit district is essentially a sheep-breeding area and carries only a comparatively small cattle population, some 20,000 head almost exclusively confined to Marsabit Mountain; whereas the sheep population is somewhere in the neighbourhood of 500,000.

This district supplies a great proportion of the sheep, of the blackfaced Persian type, exported from the Province.

Contagious bovine pleuro-pneumonia is very prevalent amongst the manyattas and it is considered that all manyattas in the district have been infected.

Blackquarter has also been reported. It has not been possible to make a definite survey of the disease position in that area.

Tsetse fly has been collected in various parts of the lower country and also on the lower slopes of the mountain.

A dairy unit exists at Marsabit but has not been availed of by the tribes.

The district also carries a number of camels.

No pupils were received at the African Animal Husbandry Training Centre at Isiolo from this district.

Wajir Distrct.

Wajir district carries a population of cattle, sheep, goats and camels, but is perhaps particularly a sheep-breeding area and also produces a considerable number of the sheep and goats exported from the Province.

Rinderpest has not been observed but contagious bovine pleuro-pneumonia is, unfortunately, present.

Tsetse fly is almost entirely confined to stretches of the Uaso Nyiro River.

There is a large number of camels which serves no other purpose than maintenance of the tribal owners and tribal transport.

A water-boring plant has operated during the year, but without success.

Two tribesmen were received at the African Animal Husbandry Training Centre, Isiolo, from this district.

Moyale and Mandera Districts.

The districts of Moyale and Mandera unfortunately received little attention, owing to pressure of time, and owing to some migratory movements of the tribes, it is almost impossible to arrive at even a tentative estimate of the stock population.

Rinderpest is, however, present on the northern boundary and is actually endemic in that area.

Small outbreaks of contagious bovine pleuro-pneumonia have been reported, though it is not considered that this disease is prevalent.

Tsetse fly exists in certain areas, particularly on the Daua River, but its actual distribution is unknown.

There are no dairy units in these districts, but there is considerable exportation of ghee made in individual manyattas, particularly from Moyale, which has even reached the Nairobi market.

There is also a considerable camel population.

Two tribesmen were received as pupils at the African Animal Husbandry Training Centre, Isiolo, from Moyale district.

Gharissa District.

Gharissa District is mainly a cattle area, but carries a considerable number of sheep and goats and a small number of camels.

Pack bullocks are used for tribal transport.

A severe outbreak of rinderpest occurred amongst the Abdulla in the neighbourhood of the eastern frontier. This disease has been more or less prevalent in that area throughout the year wtih severe mortality.

Before the short rains water became scarce and many manyattas were obliged to move towards the Tana River. As a result of this movement, rinderpest appeared amongst the Abd Wak manyattas and now shows signs of extension. Preparations are, however, now in hand to deal with this position. This outbreak caused considerable obstruction to the cattle market at Lamu and Mombasa and eventually necessitated complete closing down of these markets. Previous to this, quarantine stations were established at Gharissa and Bura to receive all trade stock from the Province to the Coast.

Contagious bovine pleuro-pneumonia has not been observed in this district.

Tsetse fly is present, particularly throughout the course of the Tana River.

There is an export trade of ghee and hides and a dairy unit has been established.

Three tribesmen were received from this district as pupils at the African Animal Husbandry Training Centre, Isiolo.

Rabies.—No outbreaks of rabies have come to notice during the year.

The Province is in permanent quarantine for contagious bovine pleuro-pneumonia and rinderpest, but, although this is the case, an endeavour has been made to localize and prescribe infected areas with the object of marketing cattle to such markets as are available from areas not known to be so infected.

Lamu.

The Lamu market was closed during the months of March, April, May and June, owing to an outbreak of rinderpest on the Coast; and the Zanzibar market was closed in July owing to the transportation of rinderpest from the Coastal area.

Since rinderpest spread from the Rama area to the Tana River, it was necessary, owing to the danger of the further spread of infection, again to stop the cattle trade to Lamu and Mombasa.

During December the sheep trade was inhibited owing to outbreaks of foot and mouth disease which occurred outside the Provinec, but on the direct routes to the Kikuyu markets.

Water Supplies.—Too much emphasis cannot be laid on this question. It is inter-related with many problems of administration and with all problems of development. It marches side by side with disease control, with increase of human and stock population, with the opening up of transport and communication, with marketing and industrial enterprises.

The Uaso Nyiro River traverses the western portion of the southern boundary and stretches in a slightly northern direction to lose itself in the Lorian Swamp. Both banks are for the most part highly infested with tsetse fly. The Tana River separates the Galla and Somali tribes of the Gharissa district in its course to the Coast, and a high state of fly infestation is also present on both banks. The Daua River runs a short course through the north-eastern portion of the Province, and, with short stretches of the Isiolo and Ngare Ndare, tributaries of the Uaso Nyiro, these are the only permanent rivers in the Province. Most other areas are supplied by wells, as in the case of Wajir and El Wak, or water holes excavated in dry sandy river beds. The methods employed for drawing water from these wells and excavations are very laborious and particularly during periods of drought it is doubtful if animal requirements are completely satisfied. In one instance observed in the Moyale district in the Bura area, as many as fifteen people were required to raise the water in containers passed from one to the other from the water level of the well to surface troughs. But however laborious such methods may be, they are reliable and satisfactory in degree, and should not be substituted by modern methods, unless the latter have been proved efficient, foolproof and entirely satisfactory.

In some areas watering is carried out every third day. This is necessitated by the fact that the grazing in the neighbourhood of a water supply is very quickly consumed and long distances must be travelled away from water to find sufficient grazing. Thus it is that emaciation sets in to be followed in extreme cases by mortality owing to lessened resistance to disease, or starvation.

Boring Plant.—To endeavour to relieve this position and for the settlement of trans-border migratory tribes for the opening up of permanent grazing areas and supplies for stock and transport routes a boring plant has been provided by the Administration from funds set aside for that purpose, but so far success has not been attained.

Marketing and Development.—The Northern Frontier Province is primarily a meat-producing area and development in other directions must be subsidiary and of secondary importance.

Cattle.—Owing to the presence of cattle diseases the export trade to outside markets is restricted almost to vanishing point. This position is in accordance with the regulations of the Diseases of Animals Ordinance.

Even under the most favourable conditions, that is to say, entire access to Lamu, Mombasa and Zanzibar, these markets could not absorb available supplies of cattle.

The Lamu market is principally an export market to Zanzibar requiring as it does on the part of traders a certain financial status to meet the immediate expenses incurred in shipment charges, etc. For this reason traders prefer Mombasa.

1,289 cattle were exported to Mombasa and Lamu during the year.

Sheep and Goats.—It is again emphasized that the export of sheep and goats from the Province through Isiolo is an industry greater than anything similar from any other native pastoral area within the Colony and that this industry must be protected and encouraged to the utmost limit.

69,851 sheep and goats were exported through Isiolo and 8,124 sheep and goats through Lamu during the year: total 77,975. This does not take into consideration the export direct to the Ukamba Province and to the Meru Reserve of the Kikuyu Province in exchange for cereal foodstuffs during periods of drought.

Sheep and Goat Skins.—An endeavour has been made and will be pursued to find an export market for sheep and goat skins, the former of which at present are practically worthless.

Hides.—Heretofore the trade in hides has been a material one and Northern Frontier Province hides, possibly with the exception of Garba Tulla hides, have maintained a high reputation in the trade, but owing to market depression this trade has practically ceased to exist.

Nevertheless, it has been demonstrated by the activities of the stock inspector of the African Animal Husbandry Training Centre, Isiolo, that hides properly prepared and shade-dried and free, or comparatively free, from branding marks, command a high price even in a depressed market, averaging, for first grade as much as Sh. 18/50 per frasila (36 lb.), which amounts to somewhere in the region of Sh. 7 per hide for light-weights and even with deduction of transport charges, represents a value of some economic importance.

Tanning—Hides and Skins.—A minor industry and one which is receiving further consideration is the tanning industry of camel hides, sheep and goat skins.

Specimens of tanned camel hides have been despatched to Europe, but trade reports have not been favourable. An alternative inquiry, however, is to be instituted in the form of untanned camel hides which are now being collected for despatch to Europe.

In a similar way tanned and untanned sheep and goat skins have been despatched, but reports have not yet been received.

Ghee.—Ghee is generally made throughout the manyattas in all the districts, but particularly so during the rains when milk is plentiful. All surplus supplies are traded through the small traders and hawkers and eventually reach Meru, the Coastal markets and Nairobi.

The quality is naturally not very high owing to unsatisfactory methods of preparation and the insanitary conditions of the manyattas and as a result the prices obtained are very low.

Grasses and Fodder Plants.—Experimental enquiries are being pursued concerning the importance of fodder plants and grasses possessing drought-resisting qualities and of nutritive values.

Plots have been planted at the African Animal Husbandry Training Centre, Isiolo, of two kinds of salt bush imported from South Africa, kurrajong, carob bean and tree lucerne, all of which have been supplied by the Agricultural Department.

It is, however, too soon to report on the success or otherwise of these experiments.

The indigenous camel bush of the Northern Frontier Province has also been under investigation but further specimens in the flowering stage are required.

Entomological.—A beginning was made of a prospective entomological survey of the whole Province, particularly in regard to tsetse fly, biting flies and ticks. The following specimens have been identified by the Entomologist at the Veterinary Laboratory, Kabete :

TSETSE FLY	DISTRICT
Glossina brevipalpis	Gharissa.
,, *pallidipes*	Mandera and Moyale.
,, *palpalis*	Marsabit Road.
,, *longipennis*	Laisamis.
,, ,,	Isiolo–Barsaloi Road.
,, ,,	Marsabit Road.
,, ,,	Garba Tulla.

BLOOD SUCKING AND PARASITIC FLIES	
Pangoni beckeri	Mandera and Moyale.
,, *ruppellii*	Ditto.
Specimen robber fly (*asilidæ*)	Ditto.
Chalcid flies	Marsabit Road.
Tabanus (gad flies)	Garba Tulla.

TICKS	DISTRICT AND HOST
Amblyomma gemma	Gharissa—Camel.
Hyalomma ægyptium	Ditto.
Rhipicephalus ?	Ditto.
Rhipicephalus pulchellus	Gharissa—Cattle.
Ornithodorus savigni	Found in the sand, Laisamis.
Amblyomma gemma (2)	Isiolo—Cattle.
Rhipicephalus pulchellus	Ditto.
Hyalomma ægyptium impressum	Through Game Department.
Dermacentor rhinocerotus	Ditto.
Rhipicephalus pulchellus	Ditto.
Amblyomma gemma	Ditto.

Laisamis Sheep-Breeding Station.

Experiments discontinued at Isiolo were recommenced in March, under the supervision of the stock inspector at Laisamis, in the Marsabit district by the purchase of one hundred Gabbra and one hundred Rendille ewes and a few rams with money set aside by the Administration for stock development.

Many of these ewes were too young for immediate mating and others were already in lamb, and continued to lamb down for several months afterwards. Such ewes as did not prove pregnant at the time of purchase were mated in December.

Although the capital expenditure for the purchase of the flock has been defrayed by the Administration, the recurrent expenditure—stock inspector's salary, labour, etc., was defrayed by the Veterinary Department.

The area selected is suitable for the purpose in so far as it is in the centre of a great sheep-breeding area, but anxiety is felt with regard to the supply of grazing since both the long and short rains failed. Approximately only three inches of rain fell during the period March to December and the flocks already show signs of losing condition.

As many as seventy-four lambs were born from matings previous to purchase. Of this number thirty-three died from malnutrition principally due to immature mating.

African Animal Husbandry Training Centre, Isiolo.

An Animal Husbandry Station has been established during the year at the Isiolo Quarantine Station where a breeding herd of native cattle is maintained. This herd consists of seventy heifers and two bulls purchased at Moyale, and later ten heifers and one bull were purchased from Samburu, making a total of eighty-three head as a foundation herd.

A small flock of Samburu and blackfaced Persian sheep is maintained for instructional purposes.

Pupils.—The first pupils to arrive for instruction were from Gharissa in the month of February, and since that time pupils have been received from the other Administrative districts, with the exception of Marsabit.

Ten pupils were resident at the station at the end of the year.

Cattle.—Calving commenced in May and since that time has been more or less at regular intervals showing a total of twenty-one heifers calved at the end of the year.

Of this number, two heifers aborted, thus showing a return of nineteen calves. Of these nineteen calves, two deaths occurred, one from snake-bite the other from gastro-enteritis.

The entire breeding herd was tested for contagious abortion. Two animals proved positive to the test, actually the animals that aborted.

All were vaccinated for rinderpest and the Moyale herd for contagious bovine pleuro-pneumonia.

Milk Yield.—Adult animals received no feed other than the natural grazing in the station. Milk yield fluctuates with the rains, increasing considerably with the flush of grass and decreasing to a comparatively low level during the dry season. Six heifers in milk during October before the rains yielded 1,050 lb. The same heifers in November during the rains yielded 1,359 lb. of milk.

Butter Fat Content.—The average butter fat yield of eleven heifers tested was 5.7 per cent. The highest individual yield was 8.6 per cent and the lowest 4 per cent.

Calves.—Birth weights are recorded immediately the calves are born, and subsequently at monthly intervals. The average birth weight was 38.5 lb., at three month old 88.6 lb, and two calves weaned at six months weighed 148 lb. and 156 lb. respectively, showing an average daily gain of .72 lb. All calves from date of birth were fed as follows: First two days 2 lb. whole milk per day in two feeds. Third to ninth day 3 lb. whole milk per day in two feeds. Tenth to sixteenth day 4 lb. whole milk per day in two feeds. Seventeenth to sixtieth day 5 lb. whole milk per day in two feeds. Thereafter until weaned at six months the ration was at the rate of 5 lb. per day separated milk and approximately 1 lb. concentrates (maize meal, bran and simsim) per day.

Ghee.—The output of ghee, six months period, was approximately 190 lb.

Shade-drying of Hides.—Hides were obtained as available from the local butchers and other sources and used for instructional and demonstrational work in shade-drying, etc.

Buildings.—Buildings of a simple and primitive type, including cow byres, calf sheds, dairies, etc., were erected at very little cost and entirely by the staff of the station.

Miscellaneous Data from Animal Husbandry Centres.

Maseno.—The dairy herd at Maseno totals 113. The average daily milk yield of heifers in first lactation, = 4.1 lb.

The average birth weight of heifer calves is 29 lb.

The average birth weight of bull calves is 33 lb.

EXAMPLES OF COMPLETED FIRST LACTATIONS

No.	Calving Date	Days in Milk	Total Yield	Average Daily Yield
			lb.	*lb.*
7	10–8–31	20	90	0·45
13	23–9–31	99	457·7	4·6
17	4–7–31	150	1,121·1	7·4
16	18–7–30	302	978·9	3·3

Sangalo.—The breeding herd consists of seventy-six cows and heifers and one bull. The average daily milk yield of heifers in first lactation = 4.6 lb.

Average birth weight of all calves = 34 lb.

EXAMPLES OF FIRST LACTATIONS

No.	Months in Milk	Total Yield	Average Daily Yield	Average Percentage Butter-fat
		lb.	*lb.*	
1	8	1,234	5·1	4·8
2	7	779	3·7	5·0
4	7	671	3·2	5·2
5	6	1,170	6·5	5·2

Machakos.—The breeding herd at this station consists of eighty-eight cows and three bulls.

Figures for ten cows which calved during 1930 and completed lactation in 1931 are :—

Average Number of Days in Milk	Average Total Yield	Daily Average
198	662 lb.	3·3 lb.

Baraton.—Breeding cows and heifers at Baraton number fifty-eight. There is one bull.

Average daily milk yield of heifers (first lactation) 7.1 lb.

Average butter fat content = 6.5 per cent.

Average birth weight of 1931 calves = 41 lb.

EXAMPLES OF MILK RECORDS (COMPLETE FIRST LACTATION)

Heifer No.	Number of Days in Milk	Total Yield	Daily Average Yield	Butter-fat
		lb.	*lb.*	*Per cent*
2	75	406	5·4	6·6
17	141	564	4·0	6·4
19	260	2,694	10·4	6·2
10	285	2,648	9·2	5·5

Isiolo.—The breeding herd consists of eighty heifers and three bulls.

Average birth weight of calves is 38.5 lb.

Average butter fat test of eleven heifers = 5.7 per cent.

Six heifers in milk in October (before rains) gave 1.050 lb.

Same six heifers, in milk in November (after rains) gave 1,359 lb.

Ngong.—In addition to the instructional herd of grade and native cattle there are three types of native cattle :—

(*a*) Boran, which number nineteen cows, nine heifers and one bull.

(*b*) Machakos, which number fourten cows and two bulls.

(*c*) Masai, of which there are thirty-five heifers and one bull, and are just coming into service.

With a view to comparing the Boran and Akamba cattle the average of the best sixteen heifers are summarized below.

FIRST LACTATION

	Akamba	Boran
Average milk yield per heifer (gallons) ..	194	200
Average lactation period (months) ..	9	7½
Number of heifers over 200 gallons ..	8	7
Average butter-fat content	6·01%	5·9%
Maximum yield (gallons)	300 (in 10 months)	290 (in 9 months)

Three Boran heifers went dry within one month after calving. In the second lactation they milked as follows :—

No.	Yield, 1st Lactation	Yield, 2nd Lactation	Months in Milk
		Gallons	
24	Dry in four weeks	338	8½
5	ditto	257	8
31	ditto	257	8½

The birth weights of calves are :

Akamba calves	35 lb.
Boran calves	40 lb.

The breeding herds from all African Animal Husbandry Training Centres total 503 head and comprise all types of native cattle existing in this Colony.

STAFF.

The staff provision and allocation among the different areas will be found in the Director's report.

(*b*) SUB-DIVISION OF ANIMAL HUSBANDRY.

The year on the whole has been satisfactory to the industry. Bearing in mind the shortage of rainfall and the infestation of locusts, it is gratifying to note that production has been maintained at a level approximating to that of the previous year, when good rains were experienced. This could only be brought about by improvements in farm management and animal husbandry methods, and with the low prices prevailing tends to emphasize the relative security of stock-farming in the Colony.

DAIRYING.

The expansion of dairying continues, and the amalgamation of the three creameries into one co-operative concern should prove of great value in consolidating the position of the cream producers. This again will be aided by the operation of the Butter Levy Ordinance, which is designed to produce funds to assist the export of butter.

Experiments have been carried out by Mr. Gunn (Rowett Institute) at the Government Farm, Naivasha, concerning milk yield and body growth in relation to supplementary feeding, etc. (*vide* Appendix X). Results indicate a useful and promising line of investigation.

As intensive dairying progresses, supplementary feeding for milk production will assume a more prominent significance in economic farm organization.

PIGS.

The pig producers, benefiting by the experiences of the previous year when surplus supplies of mediocre quality proved a distinct drug on the market, have wisely spent the year in overhauling their breeding stock, and it is hoped that during the coming year special attention will be paid to the production of a type of pig which could be expected to find favour in the overseas market.

SHEEP.

Despite the world-wide depression in the wool trade, sheep farmers continue to express their faith in the prospects of sheep farming in the Colony by steadily pursuing the building up of their flocks, and local knowledge appertaining to disease questions is increasing. It is to be regretted that, owing to inadequate staff, the Department is not in a position to give such assistance to the sheep farmers as is desirable.

POULTRY.

There is evidence that the potentialities of this Colony as an egg-producing country are slowly being realized, but much preliminary work will be necessary before rapid expansion can be achieved.

African Animal Husbandry Centres.

The work at these centres continues as rapidly as facilities will allow. The future value of this work to the European stockowners is perhaps not fully realized, but a full understanding of the possibilities of the native cattle is essential to all stock breeders in this Colony, and although results will of necessity only be forthcoming slowly, it is regarded as advisable to pursue these investigations with assiduity.

General.

Under the scheme for the assisted importation of pedigree livestock the following importations were made :—

32 bulls, 5 heifers, 4 rams, 1 boar, and 5 gilts.

These animals will prove of undoubted value to the stock breeders of the Colony.

The Live Stock Officer comments on the undesirability of increasing the number of breeds in the Colony. Bulls from ten different breeds were imported during 1931. Apart from the lack of supporting herds, the incidence of these breeds tends further to complicate the problem of grading up our herds, and it would appear that stockowners, instead of pursuing a policy of straight breeding by selection, are endeavouring to cover up the misfits so produced by the use of a bull from a breed possessing characteristics which might be expected to counterbalance such defects. Such a policy can only result in a complete mongrelizing of our herds. As the immediate future of the stock industry lies in dairying, grading up should be restricted to the use of bulls from the purely dairying breeds, and every effort made to improve the grazing conditions and farm management to support the higher grades produced.

During the year the industry and the Department received much help from the Stockowners' and Pig Industry Committees, which met from time to time, and at all times were kept in close touch with the Department.

The East Africa Stud Book Committee published a new volume during the year, and it is of interest to horse breeders to note that the horse section has been completely revised and brought into line with Wetherly's General Stud Book.

H. H. BRASSEY-EDWARDS,
Deputy Director (Animal Industry) and
Chief Veterinary Officer.

Appendix VIII

ANNUAL REPORT OF THE CHIEF VETERINARY RESEARCH OFFICER FOR THE YEAR 1931.

CORRESPONDENCE.

4,019 inward and 2,964 outward letters and telegrams were dealt with during the year, a total of 6,983. This is exclusive of communications received and despatched in connexion with slides and specimens submitted for diagnosis. The number of slides and specimens received, registered and reported upon totalled 7,031. This is 348 more than 1930, and 701 more than for 1929.

LABORATORY FARM.

The usual farming operations were carried out, including the growing of green maize for ensilage.

Seventy-one calves were born of the special breeding herd maintained at the lower farm for rearing calves under tick-free conditions.

BUILDINGS AND PLANT.

Buildings.—The general maintenance, improvement and repair of all laboratory buildings and staff quarters was carried out by the laboratory workshops' staff.

Plant and Apparatus.—The 12 n.h.p. Ransome's boiler was moved to a site nearer the main buildings, resulting in a more efficient steam service, and a considerable economy in the use of fuel.

One new electrical incubator was installed.

The steam, gas and electrical plants worked satisfactorily throughout the year.

General.—In additional to the maintenance of buildings, the workshops' staff was engaged on repairs to transport vehicles, farm implements, etc., and in the manufacture of serum and other packing cases, and various appliances for use in the work of the laboratory.

FINANCE.

Expenditure.—The sanctioned amount was £32,291 but owing to various economies effected the amount actually spent was £28,509.

Revenue.—The sale of laboratory products realized £10,476. Of this amount £7,425 was in respect of sales to other East African Governments. This is exclusive of revenue derived from rinderpest inoculations by the field staff, such revenue being shown under "Veterinary Inoculation Fees." The value of anti-rinderpest serum issued to the field staff at the scheduled rate of Sh. 2 per 50 c.c. was £16,042.

The sale of surplus live stock and hides realized £740, and £12 was derived from the sale of various stores.

LIVE STOCK.

The following table shows the number of live stock, other than small animals and poultry, dealt with during the year, including animals sent and purchased from stockowners for experimental purposes and preparation of laboratory products.

SPECIES	On hand 1-1-1931	Increase	Decrease	On hand 31-12-31
Horses	21	46	46	21
Mules	22	..	6	16
Cattle	1,277	1,290	1,732	835
Sheep	173	252	288	137
Goats	1	33	25	9
Pigs	27	56	66	17

In addition to above, 176 cattle were purchased at out-stations by members of the field staff for rinderpest virus production. These animals were taken on charge by the officers concerned, but the cost of purchase—approximately £270—was met from laboratory votes.

The number of fowls received at the laboratory for immunization against fowl typhoid and fowl-pox prior to issue to Native Reserves was 215.

TECHNICAL ROUTINE.

The number of slides and specimens submitted for diagnosis showed an increase over the previous year of 348. The total number dealt with was 7,031, comprising :—

Bovines	6,419
Equines, Horses	117
„ Mules	5
„ Donkeys	2
Ovines	121
Porcines	42
Caprines	17
Canines	96
Avians, Fowls	116
„ Turkeys	15
„ Duck	4
Various	77
TOTAL ..	7,031

LABORATORY PRODUCTS.

Anti-Rinderpest Serum.—The total quantity prepared amounted to 409,435 x 50 c.c. units, an average monthly prdouction of just over 34,000 units. Of the total issues, viz., 283,565 units, 122,000 were supplied to Uganda, 160,425 to the field staff and 1,140 direct to stockowners.

Rinderpest Vaccine..—The issues which show an increase of 16,340 courses over those for 1930 reflect increased substitution of vaccination with inactivated vaccine for active immunization by the serum simultaneous method. Each course of vaccine consists of three doses, the dose was decreased from 14 c.c. to 10 c.c., or a total of 30 c.c., for the course representing 5 grammes of spleen.

Anthrax Vaccine.—The issue of a single spore vaccine for cattle was introduced as a substitute for the pasteurian double method of vaccination.

Blackquarter Vaccine.—The formalized muscle saline extract prepared and issued by the laboratory has given satisfactory results in the practice. The issues for 1931 show an increase of 4,795 doses over those of 1930.

Blue Tongue Vaccine (for Sheep).—There was little demand for the vaccine.

Horse Sickness Vaccine.—Supplies of inactivated spleen vaccine were prepared and issued.

Pleuro-pneumonia Contagiosa Bovum Vaccine.—The issues, viz., 46,488 doses, show a decided decrease as compared with those of 1930, which were 120,184 doses.

Fowl Typhoid and Fowl-Pox Vaccine respectively were gazetted a free isue as from the beginning of October 1931. Both vaccines show a decided increase in the number of issues.

New charges gazetted during 1931 were :—

	Sh.	*cts.*
Sodium tellurite per ampoule of 10 doses	1	00
Paratyphoid feed vaccine per 20 doses	1	50
Tartar emetic solution per bottle of 4×50 c.c.	1	00
Contagious abortion agglutination test, testing of each sample..	0	50

Other products showing a decided increase in issues were :—

	Doses	
	1930	1931
Vaccine for suppurative pneumonia of sheep and goats ..	12,050	20,040
Paratyphoid feed vaccine	885	2,663

The following list shows the quantities of Laboratory products produced during the year :—

Anthrax Vaccine	8,812	doses.
Anti-rinderpest Serum	283,565	,,
Anti-swine Fever Serum	323	,,
Blackquarter Vaccine	52,335	,,
Blue Tongue Vaccine	250	,,
Colon Baccillosis Vaccine	5,893	,,
Contagious Abortion Vaccine	1,682	,,
Fowl-pox Vaccine	5,267	,,
Fowl Typhoid (K.F.D.) Vaccine	25,737	,,
Horse Sickness Vaccine	242	courses.
Paratyphoid Vaccine	2,139	doses.
Paratyphoid "Feed" Vaccine	2,663	,,
Pleuro-pneumonia Vaccine	46,448	,,
Redwater and Anaplasmosis Vaccine	281	,,
Rinderpest Vaccine	28,020	courses.
Sheep-pox Vaccine	4,000	doses.
Sodium Tellurite	6,374	,,
Suppurative Pleuro-pneumonia of Sheep and Goats Vaccine	20,040	,,
Tartar Emetic Solution	258	,,
Trypanblue Bovine	869	,,
Trypanblue Canine	159	,,
Wireworm Remedy	489,400	,,

RESEARCH.

East Coast Fever.

1.—*Prophylactic and/or Curative Experimental Inoculations.*

Attempts were made to confer, by the following means, a resistance against a severe reaction to natural infection :—

(*a*) Nine cattle, varying in age from 18 months to 2½ years, were inoculated subcutaneously and intradermally at several sites with a mixture of equal parts of fresh spleen pulp and blood collected from an East Coast fever beast *in extremis*.

Eighty-six days later the nine cattle were exposed for twenty-four hours in a highly infected East Coast fever camp and then removed to a tick-free stable and kept under daily observation.

On the sixth, fourth and second day respectively prior to exposure each beast was subcutaneously inoculated with 300 c.c. of pooled serum of six immune cattle, which prior to being bled had been kept continually exposed in a highly infected East Coast fever camp for from six to ten months, and inoculated intramuscularly with large quantities up to 30,000 c.c. of fresh citrated blood bled from cattle reacting to East Coast fever.

In addition to the serum inoculated prior to exposure, each of the nine cattle were inoculated subcutaneously with 300 c.c. of the pooled serum on the day of exposure, and 300 c.c. on each alternate day after the date of exposure till the ninth or twelfth day of exposure. The total quantity of pooled serum inoculated to each beast amounted to from 2,700 c.c. to 3,000 c.c.

Result.—Seven of the nine cattle reacted to the twenty-four hours' exposure, and died of East Coast fever. The serum produced no effect on the course and duration of the disease. The remaining two did not react, and were probably immune prior to being put in experiment.

(*b*) Seven susceptible cattle, varying in age from eighteen months to two years, were inoculated intravenously each with 20 c.c. of a mixture of equal parts of fresh spleen pulp and blood of an East Coast fever beast *in extremis*.

Result.—One reacted and died of East Coast fever. The remaining six showed no apparent reaction, and were exposed on the thirty-sixth day after the date of the spleen and blood inoculation for twenty-four hours in a highly infected camp, and then removed to a tick-free stable and kept under daily observation.

From the seventh till the fourteenth day after the date of exposure, three were inoculated daily, each subcutaneously with 300 c.c. of the pooled serum, the total quantity inoculated to each beast being 4,200 c.c.; the remaining three were not inoculated with the pooled serum.

Result.—The six cattle reacted to the twenty-four hours' exexposure and died of East Coast fever. The serum produced no effect on the course and duration of the disease.
Conclusions.

(1) Subcutaneous, intradermal and intravenous inoculation of equal parts of fresh spleen pulp and blood collected from East Coast fever cattle *in extremis*, and subsequent subcutaneous injections of large doses of pooled serum of immune cattle which had been kept continually exposed for several months and injected with large doses of East Coast fever blood rich in parasites, prior to being bled for serum, confers no resistance to East Coast fever in non-reactors to the spleen and blood inoculation.

(2) Pooled serum of immune cattle kept continually exposed to a high degree of infection, and injected with large doses of fresh blood rich in East Coast fever parasites, prior to being bled, possesses no prophylactic or curative properties.

(*c*) Intravenous injection of Liquor Iod. (Lugol's solution) in cattle reacting to East Coast fever.

Five cattle were exposed for twenty-four hours in a highly infected camp and then removed to a tick-free stable and kept under daily observation.

Result.—All reacted to East Coast fever.

On varying days after the commencement of the temperature reaction, viz., the second, second, fourth and fourth respectively, four of the cattle were injected intravenously with 80 c.c. of Lugol's solution, and a similar quantity on each of two or three consecutive days. The remaining beast was injected with 25 c.c. on the second day of the reaction.

Result.—The five cattle died of East Coast fever.

Lugol's solution at a dosage varying from 25 c.c. to 240 c.c. is of no curative value.

2.—*Transmission Experiments.*

(*a*) The difficulty of transmitting East Coast fever by various methods of inoculation of material (spleen, gland, blood) from an infected beast has, so far, been the chief obstacle in the introduction of a successful method of immunization.

The possibility of the parasite becoming adapted to cultivate more readily in susceptible cattle by passage through cattle was investigated.

The original virus (spleen) was obtained from a naturally infected beast. The first passage produced 40 per cent of reactions (ten cattle in experiment), the second passage 20 per cent (five cattle in experiment), the third 16 per cent (six cattle in experiment), and the fourth passage (six cattle in experiment), no reactions.

20 c.c. of fresh spleen pulp inoculated intravenously was used for the first passage and a similar quantity for the second passage. For the third and fourth passages the dose of fresh spleen pulp inoculated was 10 c.c. intravenously and 10 c.c. subcutaneously.

Summary.—Passage of successive generations of the virus (spleen) resulted in a decreasing number of transmissions, and at the fourth passage no reactions occurred.

(*b*) Transmission by ticks (sp. *Rhip. appendiculatus*).

Experiments carried out in 1930, and recorded in the Annual Report of the Chief Veterinary Research Officer, pp. 103–106, Annual Report of the Department of Agriculture, Kenya Colony, 1930, showed that transmission of East Coast fever was not always effected by infestation by hand of the ears of susceptible cattle with small numbers of nymphs or adults which engorged as larvæ and nymphs respectively on a beast reacting to East Coast fever. Infestation with a large number—30 to 175—had, however, invariably produced East Coast fever.

During 1931 the necessity arose of obtaining batches of ticks (sp. *Rhip. appendiculatus*) containing a pure infection of East Coast fever, for infecting cattle susceptible to East Coast fever and other tick-borne diseases.

Larvæ, the progeny of adult females which engorged on a calf susceptible to tick-borne diseases, were fed on East Coast fever reacting cattle, the blood of which showed a high percentage of East Coast fever parasites (80 per cent approximately) in the red cells and some Koch's bodies. The succeeding stage, viz. the nymphs, were fed on the ears of seven calves susceptible to East Coast fever and other tick-borne diseases, from 100 to 150 engorged nymphs being collected from each calf. Subsequently some of the seven calves were reinfested with batches of infective ticks, reacted and proved susceptible.

The intervals which elapsed between the date on which the larvæ engorged on the East Coast fever cattle, and the date on which the nymphs were fed, were as follow :—

(The method of keeping ticks at Kabete is as follows : After collection, ticks are placed in a test tube, 6 inches long by 1 inch in diameter, and the tubes plugged with cotton wool. The tubes are then placed in a glass jar containing a layer (4 inches in depth) of fine sand, kept moist with 30 per cent saline, which ensures non-contamination with moulds. The jars containing the tubes are then kept at room temperature, unexposed to direct light.)

Batch Reg. No. 524.

Larvæ engorged : 18-6-31.
Nymphs fed : 17-8-31.
Interval : 60 days.

Batch Reg. No. 526.

Larvæ engorged and collected : 19-6-31.
Nymphs fed : 21-9-31.
Interval : 94 days.

Batch Reg. No. 528.

Larvæ engorged and collected : 21-6-31.
Nymphs fed : 6-11-31.
Interval : 138 days.

Batch Reg. No. 536.

Larvæ engorged and collected : 9-7-31.
Nymphs fed : 31-8-31.
Interval : 52 days.

Batch Reg. No. 538.

Larvæ engorged and collected : 11-7-31.
Nymphs fed : 14-10-31.
Interval : 95 days.

In addition to the above, further failures to transmit East Coast fever by nymphs of another batch which engorged as larvæ on a beast reacting to East Coast fever are recorded.

Batch Reg. No. 555.

Larvæ engorged and collected : 28-12-31.
Nymphs fed : 27-1-32.
Interval : 30 days.

Result.—The ears of two calves, Nos. 7616 and 7539, were infested by hand with a large number of nymphs of Batch No. 555. Eighty engorged nymphs were collected from calf No. 7539 and forty-five from calf No. 7616. In neither case did transmission of East Coast fever occur. Larvæ, the progeny of the same adults as registered No. 555, were fed on the same East Coast fever reacting beast on which batch of larvæ No. 555 fed, and the engorged larvæ of Batch 557 collected a day later than the larvæ Batch No. 555.

Batch Reg. No. 557.

Larvæ engorged and collected : 29-12-31.
Nymphs fed : 27-1-32.
Interval : 29 days.

Result.—Calf 7613 infested by hand with a large number of nymphs, Batch No. 557, transmitted East Coast fever, the total number of nymphs which engorged and were collected from calf 7613 being 66.

Conclusions.—Infestation of the ears of susceptible calves with nymphs, varying in number from 45 to 150 (sp. *Rhip. appendiculatus*), which engorged as larvæ on cattle reacting to East Coast fever, does not invariably transmit East Coast fever.

(*c*) Transmission experiments in game.

An opportunity occurred of determining the susceptibility or otherwise of the African buffalo (*Bos caffer*) to East Coast fever. On the 24-3-31, a young buffalo of about a month old was captured in the Kijabe area, and handed over to the Laboratory on the following day.

On the 25-3-31 it was infested by hand (ears) with ticks of a proved infective batch.

Result.—No apparent reaction to East Coast fever. Smears, blood and gland, negative for East Coast fever.

On 17-6-31 the buffalo was exposed to natural infection for forty-eight hours in a highly infected East Coast fever camp, and removed to a tick-free stable and kept under daily observation and on daily temperature.

Result.—No reaction to East Coast fever; smears, blood and gland, negative.

On 20-5-31, the animal was subcutaneously inoculated with 10 c.c. blood containing *P. bigeminum*, *Anap. marginale* and *Th. mutans* infections.

Result.—No reaction to *P. bigeminum* or *Anap. marginale* occurred.

On 28-5-31 a sharp rise of temperature was recorded—105.8° Fahr.

Smears collected on 30-5-31, 1-6-31 and 5-6-31 showed small piroplasms of *Th. mutans* type, and the animal showed slight icterus of the conjunctival mucous membranes.

Summary.—Infestation of ears with East Coast fever ticks of a known infective batch, and exposure for forty-eight hours in a highly infective camp, did not produce East Coast fever in an African buffalo (*Bos caffer*).

Inoculation of blood containing *P. bigeminum*, *Anap. marginale* and *Th. mutans* did not transmit redwater or *Anap. marginale*.

Small piroplasms of *Th. mutans* type were detected in smears on the fortieth day and subsequent dates after inoculation of the blood.

Duration of Immunity in Immune East Coast Fever (T) Branded Cattle.

Exposure experiments were commenced with a view to determining the duration of immunity in cattle which survived exposure in an East Coast fever testing boma, and were accordingly T branded. T branded cattle, whose history for some years past shows that they have not been exposed to infection for some years, were purchased and exposed in the highly infected East Coast fever boma at Kabete, put under daily observation and on daily temperature. Smears were collected from any which showed a temperature reaction and thoroughly examined, and in case of reactions occurring to East Coast fever, larval and nymphal engorged ticks collected and fed after moulting on susceptible cattle and the ears infested with clean larval ticks during the reaction.

The experiments are still in progress.

RINDERPEST.

Duration of Resistance Conferred by a Course (Three Doses) of Inactivated Spleen Vaccine.

During the month of October a number of grade cattle, which had been vaccinated approximately seven months previously, and others which had been serum-simultaneously inoculated (double inoculated) and vaccinated with a course of the laboratory formalized spleen vaccine (which consists of 3 x 14 c.c. doses, each dose corresponding to 2.8 grammes of spleen, injected at seven days interval), were tested on their resistance against subcutaneous inoculation of 2 c.c. fresh citrated virulent blood.

The test was carried out under field conditions by Mr. F. R. Hale, Veterinary Field Officer. The morning temperatures of all cattle put in test were taken daily for nine days after the date of inoculation of the virulent blood. A number were kept on temperatures for several days more. The cattle are grouped according to the methods of how previously treated and age at which they underwent such, as shown in Tabulated Sheet No. 1, which also gives details of number in each group, and the results, of which Tabulated Sheet No. 2 is a summary.

It is the experience that the three doses of inactivated vaccine protect against a reaction to a dose of fresh citrated virulent blood injected seven days after the last dose, and an opportunity was afforded of determining, over a fairly large number of cattle, the duration of resistance conferred by the inactivated vaccine.

Results.—The dose of fresh virulent blood produced the greatest percentage of reactions and deaths in cattle which had only been vaccinated as sucking calves. The results confirm those previously recorded in respect to the duration of resistance conferred by vaccine in cattle vaccinated prior to weaning.

In cattle vaccinated as weaners the duration of resistance conferred by a course of vaccine varied. Some were not protected against a severe reaction and death; others were partly protected, and a large percentage (approximately 60 per cent) were completely resistant approximately seven months after vaccination.

Taking into consideration the difficulty frequently experienced in infecting susceptibles by contact, it is reasonable to conclude that a percentage of the cattle which proved non-resistant to the dose of fresh virulent blood, would not have contracted rinderpest in the event of an outbreak occurring on the farm.

The results of the test of groups Nos. 1 and 4 respectively as regards the resistance conferred by vaccine are difficult of interpretation, owing to the animals having previously been serum-simultaneously inoculated (double inoculated), as well as vaccinated. The results of the test of group 1 confirm the findings which have been recorded on different occasions, viz. the serum-simultaneous (double-inoculation) inoculation does not confer a solid immunity in a percentage of unweaned calves.

Vaccine Production.

In order to improve, if possible, the keeping properties of the vaccine, investigations were undertaken to determine whether the addition of formalin in concentrations high enough to sterilize the product bacteriologically would have any adverse effect upon the potency during cold storage. The experiment showed that the addition of formalin in a concentration of one per cent was sufficient to ensure a sterile product within a reasonable period after preparation.

Potency tests of vaccines prepared with varying concentrations of formalin at periods of from three days to six months after preparation did not reveal any appreciable differences between the various vaccines. In no case was there any appreciable decrease in potency during six months storage.

Survival of Rinderpest Virus on the Feet of Dressed Poultry.

In response to an inquiry concerning the possible risk of importing rinderpest into a clean country on the feet of dressed poultry, some experiments were made to determine the period for which the virus could survive under such conditions. The results indicated that the period of survival depended upon the promptness with which the fowls were dressed and placed into cold store. In no cases did the virus survive on the feet for a total period of seventy-two hours, although control experiments showed that both clotted and citrated blood in bottles was still infective after one month in cold storage.

DURATION OF RESISTANCE CONFERRED BY A COURSE (THREE DOSES) OF INACTIVATED SPLEEN VACCINE.
TABLE 1.

HOW PREVIOUSLY TREATED	Calved During	When Vaccined	Code	No. Tested	No. Reacted	RECOVERED		DIED		Doubtful Reactors	Non-reactors
						+Serum	—Serum	+Serum	—Serum		
(1) Double-inoculated 30–1–30 as sucking calves plus vaccine after weaning ..	1st Qr., 1929	Dec., 1930	AA	30	..	..	..	..	..	..	30
	2nd Qr., 1929	ditto	A1A	29	1	1	1	..	..	1	27
	3rd Qr., 1929	ditto	A1B	176	17	6	11	..	..	13	146
	2nd Qr., 1929	Mar.,1931	A2A	42	3	2	1	..	..	..	39
	3rd Qr., 1929	ditto	A2B	213	11	7	3	1	..	3	199
	1st Qr., 1929	ditto	A2C	30	1	1	..	..	..	..	29
(2) Vaccined as sucking calves only ..	3rd Qr., 1930	Mar.,1931	BA	316	135	74	51	8	2	24	157
	4th Qr., 1930	ditto	BB	122	92	37	29	20	6	2	28
(3) Vaccined as weaners only	3rd Qr., 1929	Mar.,1931	C	1	1	1	..	..	..	..	..
	4th Qr., 1929	ditto	CA	124	40	17	20	3	..	7	77
	1st Qr., 1930	ditto	CB	73	24	10	13	1	..	6	43
	2nd Qr., 1930	ditto	CC	182	54	29	22	2	1	13	115
	4th Qr., 1929	Dec.,1930	CA1	1	..	..	..	..	..	1	..
(4) Double-inoculated 30–1–30 as weaners under one year plus vaccine	1st Qr., 1929	Mar.,1931	D	18	1	1	..	..	..	1	16
(5) Previous history unknown plus vaccine	..	Dec.,1930	E1	14	2	..	2	..	..	..	12
	..	Mar.,1931	E2	99	16	10	6	..	..	5	78

NOTE.—Class CA might possibly have been double-inoculated, January, 1930.

TABLE II (SUMMARY OF TABLE I)

How Previously Treated	Number Tested	Number Reacted	Recovered		Mortality			Doubtful Reactors	Non-reactors
			+ Serum	—Serum	No. of Deaths	+ Serum	—Serum		
Double-inoculated as sucking calves and vaccine after weaning—Classes AA, A1A, A1B, A2A, A2B, and A2C ..	520	33 approx 6%	17	15	1	1	..	17	470
Vaccined as sucking calves only—Classes BA and BB ..	438	227 app. 52%	111	80	36 app. 8%	28	8	26	185
Vaccined as weaners only—Classes C, CA, CB, CC and CA1	381	119 app. 31%	57	55	7 app. 1·8%	6	1	27	235
Double-inoculated as weaners under one year and vaccined—Class D	18	1 app. 5·5%	1	..	..	..	..	1	16
Previous history unknown but vaccined—Classes E1 and E2	113	18 app. 16%	10	8	..	..	..	5	90

SWEATING SICKNESS.

A disease clinically resembling the disease known as sweating sickness in South Africa has been seen in calves in various part of this Colony. As with the South African condition, all attempts to transmit the disease have failed. The pathological findings in the two conditions appear to be identical.

DISEASES OF SMALL STOCK (SHEEP AND GOATS).

DISEASES OF SHEEP.

Nairobi Sheep Disease.

During the year several outbreaks of this disease were diagnozed by laboratory methods in districts from which the normal vector, *Rhipicephalus appendiculatus*, is absent. A fairly evtensive outbreak commenced in the Laikipia sheep country in March, 1931, and the disease is still present. Losses on one farm are stated to have reached a figure of five hundred sheep a month. In this area the ticks collected from sheep were *Rhipicephalus evertsi*, *Hyalomma ægyptium*, *Rhipicephalus simus* and *R. pulchellus*.

Later in the year, September to November, similar outbreaks occurred at Embakasi and at Athi River. In both these localities the prevalent species of ticks were *R. simus*, *R. pulchellus*, *R. evertsi* and *R. bursa*. Experiments were in progress as early as February to determine whether species other than *R. appendiculatus* could transmit this disease. Numerous attempts to transmit with *R. evertsi* have failed. So far it has not been possible to effect transmission with *R. pulchellus*; and on epizoological grounds it is unlikely that either of these species is concerned.

In a single instance the disease was transmitted by one of two adult *R. bursa* collected as nymphæ from a naturally infected sheep.

It was felt that *R. simus*, a species closely related to the usual vector, was in all probability the transmitting agent both in the Laikipia and the Embakasi outbreaks. A difficulty that arose in this connexion was that *R. simus* larvæ and nymphæ have never been collected from sheep or goats in Kenya and that all attempts to feed larvæ and nymphæ of this species on sheep have failed. During the collection of wild rodents for experiments on Rift Valley fever large numbers of larvæ and nymphæ of *R. simus* were taken on *Arvicanthis abyssinicus nairobi* or in the nests of this rat. It has been shown in laboratory rearing experiments that larvæ and nymphæ of *R. simus* feed so readily on this species that it must be considered to be one of their chief hosts. The adults on the other hand will not feed readily on *Arvicanthis*, but are easily raised on sheep.

Experiments designed to test the possibility of transmission by *R. simus* using *Arvicanthis* as an intermediary host of the virus are not yet complete; but it has been proved that inoculated *Arvicanthis* can retain the virus in their circulation in quantities sufficient to infect nmyphal *R. simus* up to six days after inoculation.

Attempts to produce a formalized vaccine for use against Nairobi sheep disease have failed. Control can be effected by thorough hand-dressing with oily mixtures.

Rift Valley Fever.

The investigation of the original outbreak was completed at the beginning of the year and a comprehensive account was published. Following up the suggestion already made that the virus is closely related to the viruses of yellow fever and dengue, infective material was taken to England and experiments were carried out at the Wellcome Bureau of Scientific Research. It was shown that immunity to yellow fever in monkeys (*Macacus rhesus*) did not confer immunity to Rift Valley fever. Neither dengue nor psittacosis serum conferred any protection against the new virus.

The virus was found to be highly pathogenic for rodents, particularly white mice. Certain European wild rodents (*Microtus*, *Apodemus*) appeared to be as susceptible as white mice. During the investigations in England three further human cases of the disease occurred.

The susceptibility of European rodents made it desirable to investigate the possibility that the disease might occur naturally in East African rodents, and indeed there was a history of fatal illness among wild rats on the farm where the original outbreak occurred. The most susceptible of the local species that were tested proved to be *Arvicanthis abyssinicus nairobi*. Although numerous inoculations were performed with material from rats of this species that were found dead in the Rift Valley fever area, the disease could not be proved to exist naturally.

Further experiments on transmission by mosquitoes have not yet been successful, and although it is hoped to complete this side of the investigation in the future, considerable difficulty has been experienced in keeping the suspected specis of mosquitos alive for a sufficiently long period.

DISEASES OF GOATS.

Contagious Pleuro-pneumonia of Goats.

Goats affected with this disease were forwarded to the laboratory by the Veterinary Officer of the Northern Frontier Province and a brief investigation on the etiology of the disease was made.

The disease could be transmitted to healthy goats by intrapleural or intratracheal inoculation of filtered or unfiltered pleural exudate. With material filtered through candles of the Chamberland L5 or L7 grades the incubation period varied from three to five weeks, and the post-mortem lesion was in every respect a faithful reproduction of a natural case. When unfiltered material, or material filtered through the coarse grades of candle, L2 or L3, was inoculated an earlier non-specific reaction occurred during the first ten days. Animals killed during this reaction showed none of the specific lesions of the disease. Some of those that survived reacted later with a fatal result and showed the characteristic lesions.

The strain of virus was eventually lost as a result of purchasing a batch of experimental animals most of which proved to be immune.

DISEASES OF EQUINES.

Vaccination.

Towards the end of the year the subcutaneous inoculation of four doses of spleen vaccine each dose consisting of 40 c.c. with an interval of ten days between each dose and ten days after the last dose 5 c.c. of " 0 " virus subcutaneously (vaccine plus virus method) was employed as well as the three doses of spleen vaccine, each of 40 c.c. at ten-day intervals (vaccine alone method) for the vaccination of horses against horse-sickness.

The spleen utilized for the preparation of the vaccine is obtained from a horse in the later stages of the reaction. After pulping in a Latapie pulper it is treated with 9 per cent saline in the proportion of 0.4 c.c. for each gramme of minced spleen and stored for eighteen hours at ± 1° Cent. Distilled water is then added in the proportion of 3.6 c.c. for each original gramme weight of the pulp. The bulk is then stored for several hours at ± 1° Cent. and well shaken at intervals, then screened through a layer of muslin and commercial formalin in the proportion of 1 c.c. to each 500 c.c. of the bulk added. The bulk is then stored at ± 1° Cent.

The following results are recorded :—

Result of Vaccine plus Virus Method.

Total number vaccinated, 71.

Reacted to virus inoculation and recovered, 10 = 14 per cent.

Reacted to virus inoculation and died, 3 = 4.2 per cent.

Number of vaccinated horses exposed in various parts of the Colony = 68.

Deaths from horse-sickness in vaccinated horses exposed in various parts of the Colony, 3 = 4.4 per cent.

Result of Vaccine Alone Method.

Vaccinated during the period March, 1930, to 31-12-31, total 640.

Reacted to vaccine and recovered, 17 = 2.6 per cent.

Reacted to vaccine and died, 7 = 1 per cent.

Number of vaccinated horses exposed in various parts of the Colony, 623.

Deaths from horse-sickness in vaccinated horses exposed in various parts of the Colony, 22 = 3.5 per cent.

Inactivation of Spleen Virus.

After the above-described treatment of the spleen, the vaccine is tested prior to issue on its virulency. The period during which the virus remains active in cold storage varies. In some instances vaccine stored at ± 1° Cent. for eighty days and sixty-six days respectively produced a reaction to horse-sickness, sometimes ending fatally. In other instances vaccine stored at ± 1° Cent. for twenty-eight days did not set up horse-sickness. Each lot of vaccine is tested after forty days' storage ± 1° Cent.; generally speaking after forty days' storage the vaccine causes no apparent reaction to horse-sickness. The same lot of vaccine containing an active but attenuated virus has produced varying results, viz : In a percentage of cases it set up a reaction ending fatally; in other instances a mild reaction ending in recovery and in a percentage of cases no apparent reaction. There are thus individual variations in susceptibility to the same lot of an attenuated virus.

Vaccination with spleen formalized 1—300.

Recently the quantity of commercial formalin added was increased. 1 c.c. of commercial formalin to 300 c.c. of the bulk being substituted for 1 to 500 of the bulk. Three 40 c.c.

doses at ten-day intervals set up no apparent reaction to horse-sickness and protected against a severe reaction to " 0 " virus (1 in expt.).

Inactivation of the Virus in the Blood.

Blood collected in equal parts of 1 per cent citrate solution from a horse reacting to " 0 " virus was treated with commercial formalin in the proportion of 1 c.c. to 500 c.c. of the bulk, kept in cold storage for sixteen days and 5 c.c. inoculated subcutaneously to a susceptible horse.

Result.—The virus was still active after sixteen days' storage at ± 1° Cent. and produced a severe reaction commencing on the twelfth day and ending in death on the fourteenth day after inoculation. The length of the incubation period would indicate that the virus had become attenuated.

Tests on a large number of horses would probably result in a percentage reacting and dying of horse-sickness; in others a reaction ending in recovery, and in some instances no reaction.

Activity of Toluol treated Horse-sickness Spleen kept in Cold Storage.

Spleen collected from a horse reacting to 231 days' old 3 per cent toluol treated " 0 " virus spleen was pulped in a Latapie and normal saline added in the proportion of one part pulp to four of saline passed through muslin and toluol to make 3 per cent of the bulk added, then stored in cold cabinet at 5° Cent. and for cold storage at ± 1° Cent. for 543 days. A susceptible horse was inoculated with 5 c.c. subcutaneously.

Result.—Severe reaction commencing from the twelfth day after inoculation, and death from horse-sickness on the fourteenth day.

The toluol treated spleen experimental inoculations were undertaken to determine whether spleen treated with toluol and prolonged cold storage could be advantageously utilized for preparing an attenuated vaccine. The results show that toluol has little, if any, virucidal action on the virus of horse-sickness.

Susceptibility of Foals.

Observations were made on the resistance, or otherwise, of foals to a dose of " 0 " virus subsequent to vaccination.

(a) *Foals born of mothers immunized by the vaccine plus virus method prior to pregnancy.*

Number in experiment, 2.

Number proved susceptible, 2 = 100 per cent.

Foal 1443, age 3 months. Vaccinated with one dose of vaccine and tested 10 days later with " 0 " virus.

Result.—Severe reaction and recovered.

Foal 1457, age 3 months. Vaccinated with three doses of vaccine and tested 10 days later with " 0 " virus.

Result.—Reacted mildly and recovered.

(b) *Foals that were in utero when the mother was immunized.*

Number in experiment, 2.

Number reacted to active vaccine plus virus, 0.

Number reacted to vaccine plus virus test, 0.

Foal 1412, age 3 months. Inoculated with active vaccine and subsequently " 0 " virus.

Result.—No apparent reaction.

Foal 1338, age 1 month. Inoculated with 3 doses of vaccine and a subsequent dose of " 0 " virus.

Result.—No reaction.

(c) *Foals from non-immune mares.*

Number in experiment, 5.

Number reacted to virus subsequent to vaccination, 4 = 80 per cent.

Number which did not react to virus subsequent to vaccination, 1 = 20 per cent.

Foal, 1437, age 4 months. Vaccinated with one dose of vaccine and virus ten days later.

Result.—Reacted and died.

Foal 1337, age 8 months. Vaccinated with two doses vaccine and virus ten days later.

Result.—Reacted and recovered.

Foal 1335, age 5 months. Vaccinated with three doses of vaccine and " 0 " virus ten days later.

Result.—No reaction.

Tested with another strain of virus.

Result.—Reacted and died.

Foal 1332, age 4 months. Vaccinated with four doses of vaccine and " 0 " virus six days later.

Result.—Reacted and recovered.

Foal 1327, age yearling. Vaccinated with four doses of vaccine and " 0 " virus eight days later.

Result.—No reaction.

Summary.

(*a*) Foals born of immunized mothers proved to be susceptible.

(*b*) Foals that were in utero when mother was immunized did not react to an active vaccine or to the vaccine and virus method. The probability that three doses of vaccine produced sufficient resistance to protect against a reaction to the " 0 " virus should enter into consideration.

Note.—The active vaccines inoculated to foal 1412 produced in two adult horses a severe reaction and death.

(*c*) 80 per cent of foals born of non-immune mothers proved susceptible (5 in expt.). The remaining foal (No. 1327) was in all probability protected by the four doses of vaccine against a reaction to the virus.

EAST AFRICAN SWINE FEVER.

The results of active immunization of domestic pigs by the serum-simultaneous and serum and contact methods are recorded in the Annual Report of the Chief Veterinary Research Officer for 1929, which is embodied in the Annual Report of the Department of Agriculture, Kenya, pp. 372–374, and in the memorandum on research on East African swine fever immunization communicated by the Chief Veterinary Research Officer to the 11th International Veterinary Congress, London, August, 1930.

Hyperimmune serum prepared at Kabete varying from 10 to 50 c.c., corresponding to from 1 c.c. per lb. to 1 c.c. per 5 lb. live weight, protected against a dose of 1 c.c. of a mixture of equal parts of virulent blood and O.C.G. mixture. And 10 to 35 c.c. of serum, corresponding from 0.76 c.c. to 2.5 c.c. per lb. live weight, protected against contact infection. (Total in experiment, 10).

Two months after the date of the serum-simultaneous inoculation the ten pigs were tested on their immunity to the subcutaneous inoculation of 25 c.c. of virulent blood and proved to be resistant. They were subsequently successfully hyperimmunized by intraperitoneal inoculation at fourteen days interval of three doses of fresh citrated virulent blood, each dose consisting of from 400 c.c. to 800 c.c., corresponding to 2.5 c.c. per lb. live weight. The first dose was injected seventy-four days after the date of the serum-simultaneous inoculation, or fourteen days after inoculation of the 25 c.c. dose of virulent blood.

The serum of the hyperimmunes was pooled and protected against contact infection at a dose of approximately 3 c.c. per lb. live weight.

Since the above results were obtained, a further lot consisting of eight pigs were immunized in May, 1931, with a view to hyperimmunization; all reacted, of these one died of swine fever. The survivors were tested on their immunity with ascending doses of virus; all reacted and died of swine fever (see tabulated sheet No. 1.).

Nature of Immunity.

In August and September, 1930, six domestic pigs, which reacted and recovered from the serum-simultaneous or serum plus contact method active immunization, and three pigs which reacted and recovered in August and September, 1929, to a dose of attenuated virus, were tested on their immunity, from nine months to two years later, to 20 c.c. of fresh citrated virulent blood.

Result.—All reacted and died of swine fever (see tabulated sheet No. 2).

Conclusions.

A solid immunity is not always conferred against increased doses of the same lot of virus in pigs which undergo a reaction and recover from the serum-simultaneous method of immunization, or in pigs which recover from serum plus contact infection, or in those which react and recover from a dose of attenuated virus. The immunity would thus appear to be a quantitative one.

For obtaining hyperimmune pigs, the intervals between recovery from active immunization and the immunity test with a small dose of fresh virulent blood to 5 c.c., and the interval between the increasing doses of fresh virulent blood, 5 to 20 c.c. and that between the last dose, viz., 20 c.c., and the commencement of hyperimmunization, are being increased to at least one month; fresh citrated blood being used for active immunization and for the increasing doses given prior to hyperimmunization. Fresh citrated virulent blood being used for hyperimmunizing.

EAST AFRICAN SWINE FEVER (IMMUNIZATION AND HYPERIMMUNIZATION)

No. of Pig	Live Weight	Serum plus Virus Simultaneously	Date Inoculated	Result	Immunity Test		
					Date	Dose	Result
1406	140 lb.	250 c.c. serum Lot 2 . . 250 c.c. serum plus 1 c.c. virus	27–5–31 1–6–31	Reacted and recovered	1–7–31 15–7–31 23–7–31	1 c.c. virus 10 c.c. virus 20 c.c. virus	No reaction. No reaction. Reacted and died of swine fever, 19th day
1407	120 lb.	250 c.c. serum Lot 2 . . 250 c.c. serum plus 1 c.c. virus	27–5–31 1–6–31	Reacted and recovered	1–7–31 15–7–31 23–7–31	1 c.c. virus 10 c.c. virus 20 c.c. virus	No reaction. No reaction. Reacted and died of swine fever, 18th day.
1408	120 lb.	250 c.c. serum Lot 2 . . 250 c.c. serum plus 1 c.c. virus	27–5–31 1–6–31	Reacted and recovered	1–7–31 15–7–31 23–7–31	1 c.c. virus 10 c.c. virus 20 c.c. virus	No reaction. No reaction. Reacted and died of swine fever, 11th day.
1409	120 lb.	250 c.c. serum Lot 2 . . 250 c.c. serum plus 1 c.c. virus	27–5–31 1–6–31	Reacted and recovered	1–7–31 15–7–31 23–7–31	1 c.c. virus 10 c.c. virus 20 c.c. virus	No reaction. No reaction. Reacted and died of swine fever, 20th day.
1410	130 lb.	250 c.c. serum Lot 2 . . 250 c.c. serum plus 1 c.c. virus	12–6–31 17–6–31	Reacted and recovered	1–7–31 15–7–31 23–7–31	1 c.c. virus 10 c.c. virus 20 c.c. virus	No reaction. No reaction. Reacted and died of swine fever, 11th day.
1225	300 lb.	300 c.c. serum Lot 2 . . 400 c.c. serum plus 1 c.c. virus	29–7–31 4–8–31	Reacted and died of swine fever	. .	. .	
1357	130 lb.	250 c.c. serum Lot 2 . . 250 c.c. serum plus 1 c.c. virus	12–6–31 17–6–31	Reacted and recovered	1–7–31 15–7–31 23–7–31	1 c.c. virus 10 c.c. virus 20 c.c. virus	No reaction. No reaction. Reacted and died of swine fever, 16th day.
1383	60 lb.	50 c.c. serum Lot 2 . . 50 c.c. serum plus contact infection	23–6–31 28–6–31	Reacted and recovered	15–7–31 23–7–31	5 c.c. virus 10 c.c. virus	No reaction. Reacted and died of swine fever, 7th day.

EAST AFRICAN SWINE FEVER (NATURE OF IMMUNITY)

No of Pig	Live Weight	Method of Immunization	Date	Result	Immunity Test		
					Date	Dose	Result
1323	276 lb.	90 c.c. serum lot 2 plus contact infection	1–9–30	Reacted and recovered	13–5–31	20 c.c. C.V.B.	Reacted and died of swine fever.
1325	234 ,,	80 c.c. serum lot 2 plus contact infection	1–9–30	ditto	13–5–31	ditto	ditto
1226	200 ,,	Inoculated 5 c.c. virus	10–5–29	ditto	13–5–31	ditto	ditto.
1359	40 ,,	Inoculated 2 c.c. virus	1–9–30	ditto	17–5–30	ditto	ditto.
1373	60 ,,	110 c.c. serum plus 5 c.c. virus 27 days later	10–9–30	ditto	17–5–31	ditto	ditto.
1368	60 ,,	1 c.c. virus	9–8–30	ditto	17–5–31	ditto	ditto.
1366	70 ,,	20 c.c. virus	9–8–30	ditto	17–5–31	ditto	ditto.
1371	65 ,,	5 c.c. virus	11–9–30	ditto	17–5–31	ditto	ditto.
1314	80 ,,	50 c.c. serum plus contact infection ..	10–7–30	ditto	17–5–31	ditto	ditto.

PARASITIC WORMS.

Investigations into the species of parasitic worms occurring in this country have been continued. Several new species of nematodes have been described from the ox, sheep and goat.

POISONOUS PLANTS.

Several plants were tested for toxicity by feeding or drenching experiments on sheep.

A species of *Adenia*, when freshly gathered, was shown to contain a considerable quantity of cyanogenetic gluoside After drying it was still toxic on inoculation, but no positive results were obtained by drenching.

A species of plant from Maseno, of which flowering specimens have not yet been received and which in consequence cannot be identified, was proved toxic when drenched in large quantities.

Ipomoea wightii and *Tragia brevipes* are among the plants which have been proved non-toxic, even when fed as a total ration over several weeks.

TICK SURVEY AND ENTOMOLOGICAL RESEARCH.

The researches carried out during the year 1931 by the Entomologist on the tick-problem in Kenya Colony have progressed satisfactorily.

The results of field observations have been published in bulletin form. Bulletin No. 17 of 1931 deals with the tick investigations in the Rift Valley, and another bulletin, now in Press, is devoted to a continuation of the study in the Rift Valley and in the Uasin Gishu and the Trans Nzoia districts.

Experiments on the biology of tick species have been pursued at the laboratory and these have resulted in the elucidation of some life-histories hitherto unknown. A contribution on this aspect of the study has been published in *Parasitology.*

The life-cycle of *Psoroptes communis* var. *ovis*, the "sheep scab" mite has been traced out. The period of development in Kenya Colony does not differ substantially from that observed in South Africa and in Great Britain. The subject of the control of "sheep scab" requires further investigation in the Colony.

Other acarine parasites such as *Psoroptes communis* var. *cunicula*, and *Demodex bovis* have been dealt with during the year.

Studies on the distribution of tsetse flies and other blood-sucking flies in relation to animal trypanosomiasis have been commenced; and a beginning has been made also on the problems relating to "blow-flies" and the various phases of myiasis in domestic stock and game.

By permission of Mr. R. H. T. P. Harris, of Natal, an experiment with specially designed traps to catch tsetse flies is now in progress.

PUBLICATIONS.

The following publications were published during the year:—

BULLETIN NO. 2/1931—"Observations on Ticks and Tick-borne Diseases" by Dr. E. A. Lewis.

BULLETIN NO. 11/1931—"Methods of Segregation for Control and Eradication of Bovine Contagious Abortion" by W. B. C. Danks, Veterinary Research Officer.

BULLETIN NO. 15/1931—"Diseases and Ailments of Swine" by J. Walker, Chief Veterinary Research Officer.

BULLETIN NO. 16/1931—"Diseases Affecting Poultry in Kenya" by J. R. Hudson, Veterinary Research Officer.

BULLETIN NO. 17/1931—"A Study of the Ticks in Kenya Colony. The Influences of Natural Conditions and other Factors on their Distribution and the Incidence of Tick-borne Diseases, Part I: A Report on an Investigation into the Tick Problem in the Rift Valley" by Dr. E. A. Lewis.

BULLETIN NO. 20/1931—"Horse Sickness" by J. Walker, Chief Veterinary Research Officer.

1931—"Enzootic Hepatitis or Rift Valley Fever" by R. Daubney, Asst. Chief Veterinary Research Officer, and J. R. Hudson, Veterinary Research Officer, *Journal of Pathology*, Vol. 34, pp. 545–579.

1931—"Nairobi Sheep Disease" by R. Daubney, Assistant Chief Veterinary Research Officer, and J. R. Hudson, Veterinary Research Officer, *Parasitology*, Vol. 23, pp. 507–524.

LIBRARY.

In 1929 the post of librarian was sanctioned, Mr. D. Dewar being appointed to this post in April of that year. Since this appointment, considerable progress has been made in the organization of the library on a sound basis. On his arrival, the librarian made an exhaustive inventory of all text-books and bound and unbound periodicals, and arrangements were made to replace all missing numbers of the latter as far as possible. This officer also introduced a new system of classification of text-books, which has proved extremely advantageous.

The importance of an exchange of information in regard to research being fully realized, an extensive mailing list of addresses of research institutes all over the world was drawn up, and copies of all research papers and bulletins on animal diseases issued by this Laboratory are regularly distributed to these addresses, research information being received in exchange from many of the institutes in question. The importance of such an exchange of information in the promotion of veterinary research can scarcely be adequately emphasized.

At the present moment, the library contains 416 text-books in various languages, and this list is increased annually in accordance with requirements.

British and foreign periodicals are bound in series and classified according to language, and in many instances such collections date back to 1900; it will be appreciated that they are invaluable for reference purposes. The library now contains 1,100 bound volumes of periodical and approximately another 300 volumes require binding. Fifty-one of the most important British and foreign scientific periodicals, containing articles relating to current veterinary research investigations, are subscribed to and are available for reference to all professional officers and staff. In addition, annual reports from the different veterinary research centres in the dominions, colonies and foreign countries are filed for reference.

Finally, the librarian has commenced a system of indexing and abstracting the most important articles in British and foreign periodicals bearing on research investigations into animal diseases now being carried out at the Laboratory. The value of this work is already recognized, and it is felt that it will be of fundamental importance in future years.

STAFF.

I wish to record my appreciation of the assistance given by the staff during the year.

J. WALKER,
Chief Veterinary Research Officer

Appendix IX

ANNUAL REPORT OF THE LIVE STOCK OFFICER.

(*b*) SUB-DIVISION OF ANIMAL HUSBANDRY.

DAIRYING INDUSTRY.

The development of this industry continues to be one of the chief aims of the division. Despite adverse conditions, such as the depredations of locusts, the volume of cream produced enabled the creameries to provide an exportable surplus about equal to that of the previous year.

The effective amalgamation of the three creameries into one company—the Kenya Co-operative Creamery, Ltd.—on 1st February was an event of great importance to the industry. The advantages of amalgamation will bear fruit in the near future as the company's position becomes consolidated. During a period of low export prices, the introduction of a strict grading system might appear to be inopportune, but efforts in that direction, designed to improve the quality of the raw material—cream—must be maintained. The important part played by the primary producer in the development of the industry cannot be overstressed, and while some improvement in the quality of the cream supplies was noticeable during the past year, further efforts are necessary if the export trade in butter is to be consolidated and its position in the London market improved.

Butter made from high acid cream has inferior keeping qualities to butter made from low acid cream, and in view of the cool storage and transport difficulties with which export butter is faced, a butter with long-keeping qualities is a prerequisite to success.

The continued low prices received for export butter brought into prominence the question of the stabilization of prices of dairy produce, and an Ordinance to effect this by placing a levy on all butter manufactured and sold within the Colony was passed, and the levy brought into operation on the 12th December, 1931.

The year under review provided evidence of the wisdom of the European stockowner in pursuing and developing a dairying industry; at a time when all primary products were depressed, the dairy farmer by careful management was able to hold his own.

At the request of the Directors of the Kenya Co-operative Creamery, the Live Stock Officer and the Agricultural Economist carried out an investigation into the working of the Company, and a full report was submitted to the Directors, together with a statement for publication in the Press.

The report concludes: "It must be recognized that some of the problems with which the Company is faced are beyond the need of immediate remedy, and that they will only be solved by the natural expansion of the industry, with consequent increase in supplies. Benefiting from the past few years' experience, the Company should look forward with confidence to a period of economic progression, provided it receives the whole-hearted support of the suppliers, and the results of our inspection show no reason why that support should be withheld."

Tinned Butter.

The effort to build up a trade in tinned butter continued. Various technical difficulties arose. These are being dealt with, and the advice of dairying departments from other countries has been sought, and valuable assistance received.

It is noted that these manufacturing troubles are more prevalent during the lush grass periods and also when simsim cake is used in large quantities in the herd feeding. It is hoped that when developed this trade will prove of great value in aiding the disposal of the exportable surplus of butter.

Cheese.

A slow trade in cheese was experienced throughout the year, and, discouraged by this, several producers gave up manufacture. The local cheese market is very small and easily flooded. Lack of proper curing facilities acts as a deterrent to rapid expansion of cheesemaking in the Colony. Cheese surplus to local requirements could only find an outlet in an export trade. This demands a long-keeping cheese of good quality at a very low price, and until curing rooms of a proper type are erected and a sound technique evolved little progress will be made.

Slaughter Stock.

The local market continues to be over-supplied with cattle for slaughter. Owing to drought and locust infestation, which resulted in poor grazing in many districts, the supply of high quality slaughter stock was at times restricted, but the fact remains that the European stockowners hold a number of steers far in excess of any possible local requirements. These are of a type unsuitable for export to the English market, as frozen or chilled beef, which requires carcasses of a blocky type, weighing 650 to 800 lb.

While the general stock of the country remains in the present stage of development, viz., grading up from native to dairying types, the production of unsuitable beef animals will continue, and until such time as the herds have reached a higher standardized type, on which beef qualities might be introduced when an export trade becomes practicable, it would appear desirable to rear only the very best of the bull calves for the local market. The main need at the moment is an outlet for scrub breeding stock, and much time and thought has been devoted to the solution of this difficult problem.

The proposal to erect a meat factory for the preparation of meat products and fertilizers to deal with surplus native cattle has not yet materialized, owing to the general financial position. This is to be regretted, as the experience gained in operating a meat factory of this nature would have been of great assistance to those who are endeavouring to find a solution of the surplus European-owned stock, which in the interests of good breeding it is desired to cull. The overstocking of the native reserves continues, and while it has not yet been found possible to take steps to deal with this peculiarly difficult problem, there is reason to believe that the consumption of meat by the natives is increasing.

An improvement in the native diet and an alteration in the native outlook on cattle is resulting, and this will be of assistance in the future, when effective steps can be taken to deal with the position.

THE PIG INDUSTRY.

At the beginning of the year the local market was very overloaded, but an improvement in this respect was apparent towards the end. Reduced supplies resulted from a more rigorous culling of the breeding stock, and an increasing shortage of food supplies consequent on the locust infestation of the grain-producing areas. It is probable that the statement of the Pig Industry Consulting Committee published in July had an equal effect in persuading producers to overhaul their stock. Steady improvement in the quality of supplies coming forward to the factories was noted, and it is evident that pig-keepers are benefiting from the advisory services accorded them. It is felt, however, that in the near future efforts might well be directed to a restriction of output sufficient to supply the local market. At the same time steps should be taken to evolve a type of pig suited to the overseas trade. This can only be achieved by a continual improvement in pig husbandry methods. In this connexion, it is advisable to record that considerable interest is being evinced in the large White Yorkshire breed, and several stud pigs of high quality were imported during the year. The effect of these importations will be felt in the near future, and should greatly assist in accelerating the desired improvement in type.

THE SHEEP INDUSTRY.

Sheep continued to pass through a very difficult time in 1931, little if any recovery being made from the setback which the flocks experienced in 1930. Lack of rain and locust infestations had a very bad effect on the grazing conditions in Laikipia. Wool values remained low, and the trade in fat wethers continued very slow. Nevertheless, the building up of a wool industry based on the merino is being steadily pursued, and recent well-informed opinion has expressed the view that wool will " come back " shortly.

With regard to breeding stock, there is a distinct shortage of good pure-bred rams in the Colony, and also of pure-bred ewes. Undoubtedly the importation of rams is expensive, and the attention of breeders is directed to increasing the production of country-bred rams. An increase in the number of good flock ewes is essential to enable the industry to become firmly established. The experience of the last two years has emphasized the necessity for culling the breeding stock and for the development upon systematic lines of breeding in place of the unsystematic methods which have resulted in mere propagation. The lack of a properly trained technical officer experienced in merino sheep, the mating and classing of ewes, and the preparation of merino wool for market, is particularly felt at the present stage of development of the industry.

THE POULTRY INDUSTRY.

Considerable interest has been taken in the development of the poultry industry during 1931. It is evident that supplies of eggs will in the near future be largely in excess of the local market requirements. A comprehensive bulletin on the subject of "Egg Marketing" has been prepared by the Agricultural Economist and the Live Stock Officer. The bulletin sets out the steps which must be taken by the egg producer before an export trade can be established, and suggests that as an initial step the development of the ships' stores trade should be fostered. It has yet to be realized that poultry farming is a business as specialized as any other branch of farming, and much work has to be done in connexion with the systematic culling of the flocks, the selection and mating of stock, and a solution of the many problems connected with the incubation and rearing of chicks.

Native Poultry.

The grading up of native poultry by the distribution of Rhode Island Red cockerels continued with success during 1931. During the year Local Native Councils provided funds for the purchase of 301 cockerels; and 155 cockerels, 16 pullets and 2,295 eggs were distributed free of charge from agricultural stations. That the native is showing increasing interest in this work is shown by the number of requests for pens of birds and the arrangements made by certain Local Native Councils for ensuring a supply of breeding stock for 1932. It is also felt that by encouraging the improvement in poultry the native ideas on general live stock matters and animal husbandry will gradually undergo a change resulting in his economic advancement.

INVESTIGATIONAL WORK WITH LIVE STOCK.

Reference should be made to Appendix II, which contains a summary of the work carried out on the Government Farm at Naivasha by the Rowett Research Institute, in collaboration with this Department.

SCHEME FOR THE ASSISTED IMPORTATION OF PEDIGREE LIVE STOCK.

During the year under review the following importations were made :—

32 bulls, 5 heifers, 4 rams, 1 boar, and 5 gilts.

On this service the contribution from the Government amounted to £677/2/6 in 1931. Owing to the financial position, this scheme is suspended during 1932.

The following particulars of the pure-bred cattle imported during the operation of the scheme are submitted :—

LIST OF ANIMALS IMPORTED UNDER THE ASSISTED PASSAGES SCHEME, 1928, 1929, 1930 AND 1931.

	1928	1929	1930	1931	Total
Shorthorn Cows and Heifers	..	9	1	..	10
Shorthorn Bulls	12	8	5	5	30
Friesland Bulls	3	8	..	1	12
Friesland Cows and Heifers	..	..	..	2	2
Ayrshire Bulls	11	13	..	12	36
Ayrshire Cows and Heifers	7	11	3	3	24
Red Poll Bulls	9	5	9	6	29
Red Poll Heifers	..	3	..	..	3
Aberdeen Angus Bulls	1	1	..	..	2
Welsh Black Bulls	2	..	..	4	6
Guernsey Bulls	..	..	..	4	4
Blue Albion Bulls	2	..	..	..	2
Jersey Bulls	..	2	..	..	2
Jersey Heifers	..	2	..	..	2
Belted Galloway Bulls	..	1	..	..	1
Belted Galloway Heifers	..	3	..	..	3
Kerry Bull	..	..	1	..	1
Dorset Horn Ram	2	1	..	..	3
Dorset Horn Ewes	18	..	..	..	18
Suffolk Rams	..	2	..	..	2
Romney Marsh Rams	..	2	1	4	7
Cheviot Rams	..	..	1	..	1
Cheviot Ewes	..	..	2	..	2
Large Black Boars	2	4	..	..	6
Large Black Gilts	1	3	..	..	4
Tamworth Boars	1	1	..	..	2
Tamworth Gilts	..	3	..	..	3
Large White Boars	..	1	..	1	2
Large White Gilts	..	1	..	5	6
Middle White Boars	..	1	..	..	1
Middle White Gilts	..	1	..	..	1
Berkshire Boars	4	1	..	..	5
Berkshire Gilts	2	2	..	..	4

TOTAL—125 bulls ; 44 cows and heifers ; 13 rams ; 20 ewes ; 16 boars ; 20 gilts.

ANIMALS WHICH DIED WITHIN ONE YEAR OF ARRIVAL—18 bulls; 8 cows and heifers ; 3 rams ; 6 ewes ; 1 boar ; 3 gilts.

There is no doubt that these animals have been of material assistance to the progress of the industry, and the thanks of the stockowners of the Colony are due to Government and the Empire Marketing Board for rendering such assistance possible. It is to be regretted, however, that greater advantage was not taken of the scheme to import more female stock to establish stud herds in the Colony for the supply of country pure-bred bulls.

The opinion is again expressed that in many respects it is to be regretted that so many breeds are being imported, and, in the absence of supporting herds in this Colony, breeders will find it difficult and expensive to maintain their purity and quality. It is most desirable that more female stock be imported to increase the production of bulls in the Colony of a quality good enough for their purpose at a substantially lower cost than the imported animal.

COMMITTEES.

East African Stud Book.

This Committee met during the year, and a new volume (No. 5) was published. Largely due to the efforts of the Secretary of the Royal Agricultural and Horticultural Society of Kenya (Mr. Mervyn Hill), the horse section of the Stud Book has been completely revised, and brought into line with the " General Stud Book." The rules of the Stud Book have also been revised. Other matters considered by the Committee include the inspection of herds and studs, and the identification of animals. A sum of Sh. 847/86 was held in trust by the Royal Agricultural and Horticultural Society of Kenya on account of the East Africa Stud Book as at December 31st, 1931.

The Pig Industry Consulting Committee met during the year, and published a comprehensive statement on the position of the industry. This has proved of great assistance to producers in framing their lines of development.

The Stockowners' Consulting Committee met from time to time and reviewed the steps taken to implement the resolutions of the Stockowners' Conference held in September, 1930. The Committee was kept in close touch with the departmental work on disease control, etc.

ROUTINE.

Correspondence.—Outward letters numbered 575, of which 318 were special advisory letters dealing with specific inquiries. These included the feeding of cattle and pigs, the preparation of dairy products, the supply of cattle feeds, and general stock management.

The large increase in the number of advisory letters shows the expansion of the interest now being taken in animal husbandry matters.

Interviews.—202 interviews were held at my office, when advice was given on live stock matters and general farm management.

Travelling.—3,948 miles were travelled on Government duty, and I was away from Head Office for 124 days.

Farms Visited.—Totalled 183, in the following areas: Nairobi, Limuru, Naivasha, the Kinangop, Nakuru, Molo, Songhor, Thomson's Falls, Rumuruti, Nyeri, Nanyuki, the Uasin Gishu and Trans Nzoia.

Meetings of Farmers' Associations were attended in the course of my tours, when matters dealing with animal husbandry were discussed; and in addition close touch has been maintained with branches of the Kenya Poultry Club and the Nairobi Dairying Association.

Administrative Work.—A considerable portion of my time at headquarters was occupied with administrative work in connexion with the dairying, sheep, pig and poultry industries, the trade in hides and skins, the scheme for the assisted importation of pedigree live stock, "cool" transport services, supplies of cattle feeding stuffs, and legislation in connexion with the Food and Drugs Adulteration Bill and the Butter Levy Bill.

Publications.—Articles for Press publication were supplied on the following subjects: Market Requirements of Pigs, Fodder Crops, Salt for Poultry and Live Stock in Kenya. A pamphlet on calf rearing was issued, and the pamphlet on pig feeding has been completely revised and enlarged.

Shows.—The Royal Agricultural and Horticulture Society Show at Nairobi was attended. The dairy produce and the pig classes were judged, considerable improvement over similar classes at the previous Nakuru show being noticed.

In addition, an educational exhibit was staged, dealing with the feeding of animals, and in particular the production of good bacon pigs. Through the courtesy of Messrs. the Uplands Bacon Factory, it was possible to exhibit samples of good and bad sides of bacon, with their special points delineated.

At the Society's show at Eldoret the dairy produce classes were judged, and these were found to be of a high standard.

The Provincial Show of native agriculture was attended at Mumias, the cattle and ghee classes being judged.

Nature of Work on Farms.—Farm visits were paid to most areas in the Colony as opportunity permitted, and the type of work as mentioned in my previous reports continued. It is a pleasure to be able to record the efforts which have been made to carry out previous suggestions, resulting in more efficient and economical working of the farms.

Owing to the need for stringent economy, travelling was severely curtailed, but the increase in advisory correspondence and the number of interviews indicate that stockowners are extremely anxious to take advantage of the advisory services offered.

In conclusion, I desire to place on record the help and encouragement I have received from farmers and colleagues during the past difficult year, particularly in connexion with advisory work, which forms a very important part of my duties.

W. D. D. JARDINE,
Live Stock Officer.

Note.—Statistics relating to the Live Stock Industry will be found in the Director's report.

Appendix X

EXPERIMENTAL WORK AND INVESTIGATIONAL WORK AT GOVERNMENT FARM, NAIVASHA (IN COLLABORATION WITH ROWETT RESEARCH INSTITUTE, ABERDEEN).

ANNUAL REPORT.

FARM OPERATIONS, 1931.

Constructional.

The water supply installed in 1930 leads to the cattle and sheep dipping tanks, the milking shed, dairy, and to a reinforced concrete drinking trough. Piping has been secured to conduct water one mile from the reservoir for stock not grazing near the homestead.

Considerable improvements to the existing farm buildings have been effected in order to provide more hygienic accommodation for housed live stock, particularly calves and pigs. There are now twenty-five individual calf pens, sixteen of which are floored with concrete. A piggery, comprising six pens for fattening pigs, has been built with cedar, the houses and runs having concrete flooring. The farrowing pens have also been concreted.

A considerable quantity of timber has been cut to fence off additional grazing paddocks.

Crops.

Maize was again grown for silage, but the resulting crop lacked bulk, owing to early cutting to save it from the depredations of flying locusts. Six acres of lucerne were planted on the land adjoining Lake Naivasha during the April rains. There was good germination and early growth, but the crop failed to establish on account of the low rainfall. Subterranean clover was tried, but was not a success.

Plant Introduction.

In co-operation with the Scott Agricultural Laboratories, certain varieties of crops were planted out in plots on the farm, and observations made concerning their germination, growth, etc. These were five varieties of sorghum, of which those which did best were Black Amber and Sumac. These produced an abundant growth, were very palatable to stock, and a useful crop came up after the first cutting. Mesquit and locust beans, and *Alipicarpus rugosus*, germinated to a certain extent, but failed to become established.

LIVE STOCK.

Dairy Herd.

From the point of view of rainfall, and grazing conditions favourable to milk production, 1931 could not compare with 1930, but the rainfall was fairly evenly distributed, and a satisfactory yield was maintained up till August, when locust depredations became a weekly occurrence, and the daily production dropped 50 per cent in two months.

The total number of cows carried on the farm during the year was 114, and the gross milk production was 31,984 gallons, an average per cow of 280 gallons. Calves were fed 3,722 gallons whole milk; 1,200 gallons were sold to the creamery at 40 cts. per gallon; 27,062 gallons were sold as butter fat at 85 cts. per lb; the total revenue from milk sales being £450. The cost of production has been calculated for 1931, and when labour, foodstuffs, depreciation of herd and equipment, and maintenance of bulls have been debited, but excluding land and capital charges also management expenses, the figure arrived at is 20 cts. per gallon.

The highest milk yields recorded during 1930 and 1931, for 60 completed lactation periods, show the average yield of 500 gallons per cow, with average butter fat content of 3.75 per cent, during an average lactation period of 9½ months.

Milk Production on Feeding Maize Silage.

In January, 1931, a test was begun to note the effect of the feeding of maize silage which had been in a pit for three months.

Two groups of six cows each, showing approximately equal milk yields over a preliminary period of two weeks, were treated as follows: One group (controls) was fed pasture only. The second group (silage) were fed silage up to a maximum of 26 lb. daily, during an experimental period of seven weeks. The milk yields were recorded daily. As maize silage was an entirely new food, at least three weeks elapsed before all animals in the group had acquired a taste for it, and a considerable amount of food in this way was rendered useless.

At the end of the second week the difference in average yields between the groups was 4 per cent in favour of the silage group, while at the end of the seventh week, when the test had to be terminated as the silage was all used up, the difference was 24 per cent.

A second test was started three weeks after the first had begun. There were four cows in each group, but the silage group ate readily and their increase in yield over the control group was soon apparent, reaching 35 per cent at the end of the fourth week.

AVERAGE YIELD FOR BOTH TESTS

	Pre-period, as per cent	2nd Week, as per cent	7th Week, as per cent
Control I	15·1 lb. 100%	13·0 lb. 100%	10·2 lb. 100%
Silage I	16·1 lb. 106%	14·4 lb. 110%	13·3 lb. 130%
		4th Week	
Control II	16·9 lb. 100%	11·5 lb. 100%	
Silage II	16·0 lb. 94%	14·9 lb. 129%	

Simsim Cake and Bran as a Balanced Ration for Milk Production.

In July, 1931, a test was begun to observe the effect of feeding a mixture of simsim cake and wheat bran in the ration 4 :1 on milk production during the succeeding dry months. Eleven cows were placed in each group, with total yields for the previous month approximately equal. One group received no additional feeding.

The results were as follows :—

	Pre-period	Experimental Period			
	June	July	August	Sept.	October
Group I—Control Total	5,551 lb.	5,285 lb.	4,245 lb.	3,214 lb.	1,988 lb.
Group II—Cake and Bran	5,549 lb.	5,593 lb.	5,100 lb.	4,027 lb.	3,223 lb.
Taking Group I yield at 100% from month to month					
Group II		105·8%	120·1%	125·3 %	162·1%

Damage to the grazing by locusts depressed the yield in both groups, and hay was fed during October. When the pasture experienced a recovery after the November rains, the control group failed to respond to its improvement, while the animals which had been fed from July to October increased their daily yield.

CALF REARING.

Extension of Hand-rearing Period.

In 1930, calves were generally weaned off milk and concentrates when six months old. It was observed in several instances that the live weights remained stationary or decreased during the succeeding two months. In 1931, the effect of extending the period of hand feeding to nine months was investigated.

Two groups of calves, balanced in respect of birth weight, received similar treatment until about six months old, when one group was gradually weaned off, while the other continued to receive separated milk at the rate approximately of one gallon per day, until the age of nine months.

The average weights of the two groups during the period, the amounts per head of concentrates and milk consumed, together with cost of rearing, are given below :—

AVERAGE BIRTH WEIGHTS—POUNDS

	At birth	6 months	7 months	8 months	9 months	10 months	11 months	12 months
Group I (weaned at 6 months) ten calves	62·3	257·6	232·3	291·5	300·3	327	344	373
Group II (weaned at 9 months) ten calves	62·8	262·4	297·4	322·7	349·1	377	396	434

When the calves had reached the age of nine months, there was a difference in live weight of 50 lb. per head in favour of the group being hand fed for three additional months. Subsequent weights are given to show that this group was increasing its lead at 12 months.

FEEDING

	Whole Milk		Separated Milk		Concentrates		Total Cost per Calf
	Gal.	Cost	Gal.	Cost	lb.	Cost	
		Sh. c.		*Sh. c.*		*Sh. c.*	*Sh. c.*
Group I average per calf	34	6 80	165	16 50	180	6 89	30 19
Group II average per calf	35	7 00	263	26 80	180	6 89	40 69

Whole milk is charged at cost of production, Cts. 20 per gallon. The difference in cost of rearing is Sh. 10/50 per calf, which is repaid by increased rate of growth after weaning.

IRON DEFICIENCY.

Feeding Experiment.

Among cattle grazing on a certain area extending south and south-west from Lake Naivasha, on soil of laval origin, cases of emaciation occur in spite of adequate supplies of pasture. Clinical observations suggest a dietic deficiency similar to "Nakuruitis," and cattle removed to good grazing have recovered condition.

A test is meantime being carried out on one farm in that area, where there were several cases indicative of malnutrition, to find if the feeding of iron-rich "licks" prevents the incidence of emaciation.

On 1st September three groups, of ten bullocks each, were placed on experiment, balanced according to liveweight, and treated as follows:

One group has access to a salt mixture, 33 per cent iron oxide, 67 per cent salt.

One group has access to a complete mineral mixture, with 5 per cent iron oxide.

The third group receives no supplement. These bullocks had not previously been grazed on this farm.

Six cows with calves at foot, in a state of emaciation, were added to each of the above groups, and as they have displayed little interest in the supplements offered, they are drenched once per week with the respective mixtures.

When the test began, grazing was abundant, but repeated swarms of locusts have devastated the pasture, so that the quantitative factor must also be considered. There is meantime little difference in condition in the groups, and until the pasture is renewed after the long rains, no significant result may be anticipated.

Growth Rates of Steers and Heifers, correlated with the Monthly Rainfall and Condition of the Pasture.

Chemical analysis of the pasture on the farm has shown that during dry weather, the mineral and protein constituents are relatively low compared with the carbohydrate content, the grazing during these periods being most favourable for fattening cattle provided the fibre content of the grasses is not very high. The flush of new grass after rain is exceptionally high in mineral salts and unorganized nitrogenous constituents, and has a very laxative effect on grazing animals. Fattening cattle at this time show a marked loss in weight, while this is less apparent in younger stock which utilize a relatively larger amount of minerals and protein in promoting skeletal growth and the formation of new body tissues.

When the flush of new grass begins to dry off, conditions become optimal for the increase in growth and live weight, as the animal body now well stocked with tissue-forming substances is able to utilize the higher carbohydrate content of the pasture, which at this stage is comparatively low in indigestible fibre.

The effect of the foregoing conditions on the live weights of growing and fattening cattle on the farm has been observed since November, 1930, when at different stages of growth and maturity. The average weights from month to month, along with the rainfall, are recorded on a separate sheet.

Group I.—Forty steers, over two years old, grazed on the farm for six months prior to the first weighing. These were nearing the fattening stage.

Group II.—Four work oxen believed to be suffering from malnutrition, brought on to the farm in November, 1930, to observe their reaction to good grazing. They were distinctly emaciated and apparently beyond restoration or arrival.

Group III.—Thirty-two steers bought in January, 1931, off comparatively poor grazing and in fair condition. They were yearlings when purchased.

Group IV.—Twenty young steers reared on the farm, and weaned before November, 1930.

Group V.—Twelve young heifers, home reared.

Groups IV and V were in thrifty condition when the first weighings were recorded. (*See* following table.)

STEERS AND HEIFERS—LIVE WEIGHTS—AVERAGES, 1930-31—CORRELATED WITH RAINFALL

	1930		1931												1932
	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
Rainfall—Inches	2·33	1·37	0·14	1·05	3·24	3·53	1·73	2·25	1·25	2·14	1·07	0·99	2·54	1·06	0·15
Average Live Weight (lb.)—	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*
Group I—2-year old steers ..	828	817	857	906	890	838	906	932	953	983	973	941	947	894	983
Group II—Emaciated oxen (4)	912	946	1,030	1,085	1,076	1,048	1,135	Returned to owner.							
Group III—32 young steers ..	..	..	..	467	492	508	559	604	642	674	664	645	653	628	723
Group IV—Home-reared steers	355	394	451	479	495	502	557	604	639	648	646	633	643	630	714
Group V—Home-reared heifers	279	314	347	386	404	425	487	536	571	563	604	599	558	583	670

The effects of the pasture condition arising from the short rains of 1930 and the long rains of 1931, on the above groups of different ages, may be observed. From August, 1931, till December, 1931, locusts were the controlling factor in the grazing, and the weights are accordingly erratic.

SHEEP.

Contrasted with 1930, when the rainfall was 40 inches, 1931 with 20 inches, provided pastoral conditions more favourable to the well-being of sheep. There were some losses due to "Rift Valley Fever" and suspected "Nairobi Sheep Disease", and some deaths among newly-weaned lambs as the result of locust visitations.

The wool clip marketed in November, 1931, realized on deduction of all expenditure incurred after leaving the farm, 4.16 pence per lb.

Experimental.

In June, 1931, a test was begun to note the effect of feeding a salt-bone meal mixture to newly-weaned lambs, two groups with thirty ewes and thirty wethers in each, being selected. Conditions were favourable to sheep until September, when the finer grasses were cleaned up by locusts, and the groups were running equal. Both groups then suffered a set back, which was less marked in the group being fed the salt mixture. By the end of December, both groups had improved after the short rains, but the mineral fed group still maintained their lead over the control group.

	CONTROL GROUP		MINERAL GROUP	
	Wethers	Ewes	Wethers	Ewes
	lb.	*lb.*	*lb.*	*lb.*
15th September, average weight ..	56·40	52·40	56·86	52·82
15th November, average weight ..	49·21	47·04	54·00	51·17
Loss in weight per head	7·19	5·36	2·86	1·65
31st December, average weight ..	56·56	54·56	63·26	57·54
Average increase 15th September–31st December	1·16	2·16	6·40	4·72

Improvement of Native Sheep.

A flock of Masai ewes is used for crossing by imported Suffolk and blackheaded Persian rams, observations being recorded of the birth weights and subsequent rate of growth of the progeny. Figures are included for pure-bred Persian and unimproved Masai lambs.

	MALES		FEMALES	
	Average weight at birth	Average weight at ten weeks	Average weight at birth	Average weight at ten weeks
	lb.	*lb.*	*lb.*	*lb.*
Suffolk—Masai Cross ..	8·8	39·5	8·0	33·0
Persian—Masai Cross ..	6·3	30·5	5·8	27·5
Masai Lambs	6·8	..	5·8	..
Purebred Persian ..	5·3	..	5·0	..

Lambs born in 1930. (*Average weights*) :—

Masai wethers (22 months)	82 lb.
Masai ewes (22 months)	78 lb.
Suffolk-Masai cross wethers (12 months) ...	72 lb.
Suffolk-Masai cross ewes (12 months) ...	69 lb.

The cross lambs by Suffolk and blackheaded Persian rams are hardy and comparatively resistant to disease, while they maintain a good and even rate of growth.

PIGS.

Substitution of meat meal and earthnut cake in lieu of separated milk for bacon production.

A feeding test was carried out from September, 1930, to January, 1931, to determine the effect of the substitution of locally available meat meal, and earthnut cake in the ration of fattening pigs to replace separated milk.

Two groups of recently weaned pigs, eleven in each group were fed as follows :—

Group I.

Crushed maize 200 parts.

Pollards, 100 parts.

Meat meal and cake, 75 parts.

Group II.

Crushed maize, 200 parts.

Pollards, 100 parts.

Separated milk, 5 lb. per head daily.

Both groups increased in weight at an even rate. The live weight increase, and cost of food consumed from the beginning of the test until the pigs were disposed of for slaughter, are given below.

	Average weight 27–9–30	Average weight 4–1–31	Gain in 100 days	Cost of food per head
	lb.	*lb.*	*lb.*	*Sh. cts.*
Group I (Cake and Meat Meal)	46·6	180·9	133·4	23 85
Group II (Separated Milk)	46·7	186·6	138·9	18 48

When slaughtered at the Uplands Bacon Factory the carcasses were examined and judged by the Livestock Officer, Department of Agriculture. Carcasses were assessed individually, and an analysis of the judge's remarks showed that the pigs fed meat meal and earthnut cake produced bacon equal in quality to those which had been fed separated milk. Certain carcasses from each group were lacking in quality—probably the results of breeding, as the pigs were cross bred.

It was decided to run a similar experiment using the same rations, but grouping and feeding the pigs from birth. Two groups of three litters each were used. At weaning, towards the end of January, both groups were equal in weight. To simplify the ration, meat meal alone was used to replace milk. In three months the milk fed group averaged 20 lb. more than the meat meal group which were less thrifty in condition. Unfortunately the test could not be followed to a definite conclusion, as an outbreak of swine fever caused it to be abandoned.

All the breeding and fattening pigs, forty-four in all, died from swine fever, and no pigs were kept on the farm until the end of December, when one large white gilt in pig was imported, and two pedigree large black gilts were purchased. The immediate aim is to mate females of the large black type with large white boars, and note the rate of growth, maturity and finally the quality of bacon of the progeny.

PASTURE EXPERIMENTS.

Effect of Fertilizers.

In June, 1930, an experiment was laid down to test the effect of the application of mineral fertilizers on the natural grazing. The following single fertilizers were used in two dressings, one half in June, 1930, one half in November, 1930, during the short rains :

Nitrate of soda, 1 cwt. per acre.

Magadi soda (carbonate), 4 cwt. per acre.

Superphosphate (calcium), 4 cwt. per acre.

Ground limestone, 2 tons per acre.

The plots, each with an area of 100 square yards, were arranged on the " latin square " principle, there being five plots for each fertilizer and five control plots. Samples were collected for chemical analyses before the dressings were applied. The herbage was then mown and the plots fertilized, the dressings being repeated in November.

In June, 1931, when growth consequent on the long rains had become stationary, the yield per acre of freshly cut grass was calculated and composite samples from the fertilized and control plots taken for chemical analyses. The figures tabulated below show the percentages of the various constituents in the samples collected in 1930 before fertilizing and in June when growth had stopped.

	CONTROL		NITRATE OF SODA		MAGADI SODA (Carbonate)		SUPERPHOSPHATE		GROUND LIMESTONE	
	June, 1930	June, 1931	June, 1930	June, 1931	June, 1930	June, 1931	June, 1930	June, 1931	June, 1930	June, 1931
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Fibre	32·00	30·69	30·19	30·29	32·84	28·16	29·56	30·93	30·65	31·72
Acid Soluble Ash ..	5·51	3·18	5·45	4·22	6·00	3·95	5·87	3·50	5·48	3·73
Lime	0·53	0·49	0·665	0·57	0·637	0·53	0·75	0·51	0·69	0·48
Phosphoric Acid ..	0·648	0·35	0·725	0·38	0·792	0·44	0·81	0·41	0·72	0·39
Nitrogen	1·99	0·91	1·47	1·02	1·88	1·02	1·85	0·81	1·73	0·94
True Protein ..	6·56	4·00	5·84	4·72	6·63	4·99	6·22	4·20	6·02	4·14
Chlorine	0·385	0·19	0·37	0·33	0·37	0·27	0·35	0·25	0·41	0·34
Potash	2·554	0·94	2·802	1·65	2·66	1·34	3·27	1·15	2·09	1·38
Soda	0·218	0·32	Trace	0·29	0·23	0·23	Trace	0·31	0·59	0·51
Yield per acre ..	..	2,928 lb.	..	4,694 lb.	..	3,920 lb.	..	4,370 lb.	..	4,404 lb.

From the above figures, the great decline in nutritive constituents from 1930 to 1931 is at once apparent. The differences between the fertilized plots and the controls in 1931 are not significant. The difference in yield is, however, quite definite, but the prolongation of a high nutritive content by the application of fertilisers was not obtained.

In 1930, the rainfall up to May 31st was 29.68 inches. For the corresponding period in 1931, 9.69 inches only were recorded. Adequate rainfall would appear to be the prime factor in maintaining a pasture of high nutritive value on the Naivasha type of soil.

Individual Grasses.

Samples of individual grasses, growing on the farm in association, under equal conditions of soil and rainfall, were collected for analysis in June, 1930.

The results are given below. (*See* page 98.)

The outstanding individual grass is No. 3, locally designated Naivasha Star Grass. It responds to successive showers by the growth of additional leafage, hence its high nutritive value is maintained so long as the rainfall is adequate. The other grasses mature more quickly and would have to be grazed down in order to prolong their nutritive value after their early growth. The white clover, No. 7, appears only when the ground has been thoroughly saturated, and wilts immediately conditions suggestive of drought prevail.

The chemical analysis of pastures discussed above has been carried out through the courtesy of the Department of Agriculture of Southern Rhodesia.

	1 *Harpachne schimperi*	2 *Themeda triandra*	3 *Cynodon plectostachyium*	4 *Eragrostis tenuifolia*	5 *Anstida abscensionis*	6 *Eragrostis species*	7 White Clover indigenous
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Fibre	33·15	33·25	24·53	35·24	36·50	35·69	28·10
Lime	0·44	0·46	0·80	0·55	9·33	0·43	1·34
Acid Soluble Ash ..	3·35	3·39	6·86	2·83	2·46	2·80	8·20
Phosphoric Oxide ..	0·58	0·14	1·14	0·55	0·47	0·47	0·67
Nitrogen	1·10	0·99	2·24	0·87	0·83	0·93	2·29
True Protein	5·25	5·08	9·97	4·20	4·14	4·52	11·96
Chlorine	0·16	0·22	0·52	0·19	0·06	0·07	0·29
Potash	0·94	0·90	2·07	0·94	0·57	0·53	2·95
Soda	0·55	0·57	0·37	0·33	0·27	0·02	0·13

FARM VALUATIONS

VALUATION, 1ST JANUARY, 1931.	*Sh. cts.*	VALUATION, 31ST DECEMBER, 1931.	*Sh. cts.*
1st January—		31st December—	
Live Stock	52,660 00	Live Stock	66,475 00
Implements and Equipment ..	3,822 50	Implements and Equipment ..	3,592 73
Foodstuffs (grown and purchased) on hand	688 20	Foodstuffs (grown and purchased) on hand	1,026 27
TOTAL .. *Sh.*	57,170 70	TOTAL .. *Sh.*	71,094 00

FINANCIAL STATEMENT.

I.—FARM CURRENT ACCOUNT.

RECEIPTS	*Sh. cts.*	PAYMENTS	*Sh. cts.*
1-1-31 Balance at Bank brought forward ..	6,748 59	31-12-31 Expenditure as per Cash Book	12,155 06
31-12-31 Sales as per Cash Book	17,114 39	20-8-31 Payment made to Deposit Account ..	3,000 00
		31-12-31 Balance as per Bank Book	8,707 92
Sh.	23,862 98	*Sh.*	23,862 98

II.—DEPOSIT ACCOUNT.

RECEIPTS	*Sh. cts.*	PAYMENTS	*Sh. cts.*
1-1-31 To Fixed Deposit with National Bank of India, Nairobi, brought forward ..	6,000 00	31-12-31 By Balance on Fixed Deposit	9,292 00
20-8-31 Interest on above ..	292 00		
20-8-31 Placed on Fixed Deposit with National Bank of India, Ltd.	3,000 00		
Sh.	9,292 00	*Sh.*	9,292 00

H. GUNN,
Rowett Research Institute.

Appendix XI

DEPARTMENT OF AGRICULTURE

Principal changes and new appointments in technical staff during 1931—

I. ADMINISTRATIVE AND GENERAL.

Staff Changes

Mr. A. C. Hunter, Statistical Officer, proceeded on leave on 13th June pending retirement. Post abolished.

Mr. V. Liversage, B.Sc., (Lond.), M.S.(Wis.), N.D.A., Agricultural Economist, arrived on first appointment on 12th February.

2. SCOTT AGRICULTURAL LABORATORIES.

Mr. G. H. Gethin Jones, M.Sc., Soil Chemist, arrived on first appointment on 7th May.

3. DIVISION OF NATIVE AGRICULTURE.

Mr. R. G. Bentall, B.Sc.(Agric.), Agricultural Officer, proceeded on leave 2nd December pending termination of appointment.

Mr. R. Finch, B.A., Dip. Agric., Assistant Agricultural Officer, proceeded on local leave on 1st May, pending termination of appointment.

Mr. A. B. S. Ransford, Dip. Agric., (S.E.A.C.), Agricultural Officer, proceeded on leave 1st August pending termination of appointment.

Mr. H. J. Taylor, Dip. Agric., (S.E.A.C.), transferred to Education Department 26th May.

Mr. C. D. Thornton, B.Sc., (Agric.), Temporary Assistant Agricultural Officer, appointment terminated 31st March.

4. COFFEE AND SISAL SERVICES.

Mr. C. B. C. Handley, B.Sc. (Agric.), Assistant Agricultural Officer, resigned 10th May.

Messrs. H. N. Jones, H. L. Bolton, H. R. H. Stone, C. D. Knight and G. S. Powell, appointed Plant Inspectors on abolition of posts of Temporary Coffee Inspectors, 1st January.

5. GRADING AND INSPECTION AND COOL STORES SERVICES.

Mr. E. L. Bradford, Dip. Agric., Assistant Grader and Inspector, temporarily transferred for service with the Locust Campaign in May.

Mr. A. D. T. Montagu, Assistant Grader and Inspector, transferred to Gold Coast, 5th January.

6. DIVISION OF ANIMAL INDUSTRY. -

Major H. H. Brassey-Edwards, M.R.C.V.S., appointed Deputy Director (Animal Industry) and Chief Veterinary Officer, with effect from 1st January.

Mr. J. Anderson, M.R.C.V.S., Veterinary Officer, arrived on first appointment 22nd October.

Mr. C. G. Bishop, Stock Instructor, transferred from post of Agricultural Officer, 23rd March.

Mr. H. Fitzgerald, Stock Inspector, appointment terminated 16th March.

Mr. C. Glover, Stock Inspector, proceeded on leave 21st February, pending termination of appointment.

Mr. R. A. Hammond, M.R.C.V.S., Veterinary Officer, arrived on first appointment on 8th January.

Mr. K. S. Smith, Temporary Stock Inspector, appointment terminated 30th April.

Mr. H. Thorne, Stock Inspector, proceeded on local leave 1st July, pending termination of appointment.

7. DIVISION OF VETERINARY RESEARCH.

Mr. J. Burton, Overseer, proceeded on leave pending retirement, 11th June.

Mr. G. M. Eames, appointed Stockman on 10th February, and advanced to the post of Overseer on 12th June.

Mr. W. Fotheringham, M.R.C.V.S., temporarily transferred as Veterinary Research Officer on 19th July.

STAFF LIST

As at 31st December, 1931.

A.—ADMINISTRATIVE AND GENERAL

Director.—Alex. Holm, C.B.E., F.H.A.S., M.R.A.S.E. (Gold Med.), S.E.A.C. (Dip. Hons.).

Assistant to Director.—D. L. Blunt, M.A.

Agricultural Economist.—V. Liversage, B.Sc. (Lond.), M.S. (Wis.), N.D.A.

Statistical Officer.—A. C. Hunter.

Accountant.—H. S. Land.

Office Superintendent.—E. J. Kelly.

Clerks.—R. Abram, J. S. de W. Ainsworth, Miss M. V. Ashe, Mrs. M. A. Carr Hole, A. Clough, P. M. Corfe, Miss H. M. Dewar, J. B. Gould, J. E. Harrison, A. J. Kemp, S. Morrell, J. S. Nelson, Miss A. O. P. O'Meara, R. F. G. Palmer, F. Parker, J. Riddell, A. Wake, Miss J. Webster.

B.—DIVISION OF PLANT INDUSTRY.

Deputy Director.—H. Wolfe, M.Sc. (Agric.).

Senior Coffee Officer.—A. D. le Poer Trench.

Agricultural Officers.—P. Booth, N.D.A., U.D.A., D. C. Edwards, B.Sc. (Agric.), N. Humphrey, A. C. Maher, B.A., Dip. Agric. (Cantab.), A.I.C.T.A. (Trinidad).

Plant Inspectors.—H. L. Bolton, H. N. Jones, C. D. Knight, G. S. Powell, H. R. H. Stone.

Sub-division of Native Agriculture.

Agricultural Officers.—A. G. Bailey, M.A., R. G. Bentall, B.Sc. (Agric.), E. Cottington, G. W. Gaddum, B.Sc. (Agric.), Dip. Agric. (Wye), M. H. Grieve, B.Sc. (Agric.), A. S. Hartley, W. G. Leckie, B.Sc., C. O. Oates, N.D.A., W. O. Sunman, B.Sc. (Agric.), Dip. Agric. (Wye), W. L. Watt, Cert. H.A.S. Forestry, T. Y. Watson, B.Sc., Dip. Agric. Sci. (Cantab.).

Scott Agricultural Laboratories.

Senior Entomologist.—T. J. Anderson, M.A., B.Sc. (Hons. Edin.), F.Z.S., F.E.S.

Entomologists.—H. C. James, Ph.D., B.Sc., N.D.A., N.D.D., R. H. Le Pelley, Ph.D., D.I.C., B.Sc. (Hons.), A.R.C.Sc., F.E.S., F. B. Notley, B.Sc. (Hons.), H. Wilkinson, A.R.C.Sc., F.E.S., F.L.S.

Senior Mycologist.—J. McDonald, D.F.C., B.Sc. (Hons.), F.L.S.

Mycologist.—C. A. Thorold, B.Sc.

Senior Agricultural Chemist.—V. A. Beckley, M.C., M.A., A.I.C.

Soil Chemist.—G. H. G. Jones, M.Sc.

Agricultural Officer.—S. Gillett, Dip. Agric. Hons. (Wye).

Laboratory Assistant.—F. McNaughton, B.Sc.

Junior Laboratory Assistants.—F. W. Evans, E. C. M. Green, R. N. Noble, J. W. Phillips.

Learner Laboratory Assistants.—G. Finch, A. S. M. Gilfillan.

Manager of Insectaries.—T. L. McClelland, M.C.

Clerk.—B. A. Pickering.

PLANT BREEDING SERVICES.

Senior Plant Breeder.—G. J. L. Burton, M.C., B.A.

Plant Breeder.—R. J. Lathbury, M.A.

Agricultural Officer.—N. D. Spranger.

Junior Laboratory Assistant.—G. Gamble.

GRADING AND INSPECTION AND COOL STORES SERVICES.

Chief Grader and Inspector.—C. L. Silvester, N.D.A., N.D.D.

Grader and Inspector.—F. B. L. Butler, F.L.S.

Assistant Grader and Inspector.—E. L. Bradford.

Superintendent Maize Conditioning Plant and Cool Stores.—D. F. Sargent.

Mechanic.—A. E. Taylor.

Clerk.—H. S. Cuthbert.

C.—DIVISION OF ANIMAL INDUSTRY.

(*a*) ADMINISTRATIVE AND EXECUTIVE DIVISIONS.

Deputy Director (Animal Industry) and Chief Veterinary Officer.—H. H. Brassey-Edwards, M.R.C.V.S.

Deputy Chief Veterinary Officer.—Vacant.

Senior Veterinary Officers.—O. Dixon, M.C., M.R.C.V.S., R. C. Wheeler, M.B.E., M.R.C.V.S., J. T. C. Bradshaw, M.R.C.V.S.

Veterinary Officers.—R. Scott-Little, M.R.C.V.S., D.V.S.M., R. L. Creery, M.R.C.V.S., E. J. Mulligan, M.R.C.V.S., W. J. Emerson, M.R.C.V.S., F. R. Hale, M.R.C.V.S., E. Beaumont, M.R.C.V.S., T. B. McClure, M.R.C.V.S., H. Hay-Barclay, M.R.C.V.S., D. F. Macpherson, M.R.C.V.S., W. M. McKay, M.R.C.V.S., F. W. Aston, M.R.C.V.S., D.V.S.M., R. A. Hammond, M.R.C.V.S., J. Anderson, M.R.C.V.S.

Stock Inspectors.—D. Wyartt, R. A. C. Campbell, W. L. Lewis, G. White, H .E. Evans, L. E. Smith, J. Harris, J. F. Greig, C. B. Jolley, F. H. Poolman, J. Denwett, J. H. Ward, R. H. Cameron, F. J. O'Hara ,A. R. Paxton, G. L. Murray, G. D. Cowen, C. G. Norman, G. D. Henderson, G. Alcock, G. W. Low.

(*b*) DIVISION OF VETERINARY RESEARCH.

Chief Veterinary Research Officer.—J. Walker, O.B.E., M.R.C.V.S.

Assistant Chief Veterinary Research Officer.—R. Daubney, M.Sc. (Wash.), M.R.C.V.S.

Veterinary Research Officers.—J. R. Hudson, B.Sc., M.R.C.V.S., W. B. C. Danks, B.Sc., M.R.C.V.S., W. Fotheringham, M.R.C.V.S.

Laboratory Superintendent.—A. Walker.

Laboratory Assistants.—J. T. Schultz, H. J. Gray, J. R. McQueen, E. J. Hall, W. P. Bruce, F. Lyons, J. Forsyth, S. R. Pelling.

Overseer and Stockman.—G. M. Eames.

Yard Foreman.—A. McDougall.

Clerks.—J. H. Crampton, A. E. Dawes, Miss R. M. Dennis, L. O. Johnes, S. G. Sharp.

Librarian.—D. Dewar.

Mechanic.—O. Stenmark.

Storekeeper.—J. Scott.

Assistant Storekeeper.—G. W. Clochley.

Laboratory Students.—W. P. Langridge, E. W. Temple-Boreham.

(*c*) ANIMAL HUSBANDRY.

Live Stock Officer.—W. D. D. Jardine, B.Sc. (Edin.), N.D.A., N.D.D. (Hons.).

Instructors in Stock.—J. Anderson, C. G. Bishop, H. C. W. Guy, A. Lambie.

Appendix XII

KENYA RAINFALL, 1931.

	Total Rainfall	Average Rainfall	No. of Years	Excess	Deficit
	Inches	*Inches*		*Inches*	*Inches*
COAST PROVINCE—					
Lamu	48·46	36·71	23	11·75	..
Malindi	39·22	39·91	37	..	0·69
Kwale	45·32	37·41	20	8·11	..
Teita, Voi	21·90	21·02	20	0·88	..
UKAMBA PROVINCE—					
Kitui	32·12	40·44	27	..	8·32
Machakos	43·50	36·50	36	7·00	..
KIKUYU PROVINCE—					
Nairobi	39·18	36·74	15	2·44	..
Kiambu	48.77	41·47	23	7·30	..
Fort Hall	52·91	45·54	30	7·37	..
Embu	49·02	41·48	23	7·54	..
Meru	58·91	53·72	18	5·19	..
Nyeri	34·27	37·25	27	..	2·98
Naro Moru	23·97	25·84	17	..	1·87
NAIVASHA PROVINCE—					
Naivasha	26·86	29·14	27	..	2·28
Laikipia–Rumuruti	25·79	28·58	19	..	2·79
RIFT VALLEY PROVINCE—					
Nakuru	37·07	36·45	22	0·62	..
Ravine	46·27	43·92	28	2·35	..
NZOIA PROVINCE—					
Uasin Gishu–Eldoret	44·27	41·32	21	2·95	..
Trans-Nzoia–Kitale	47·80	44·89	10	2·91	..
NYANZA PROVINCE—					
Kisumu	38·37	44·86	28	..	6·49
Kakamega	84·79	73·96	33	10·83	..
Kisii	75·82	68·63	20	7·29	..
Lumbwa	45·27	47·70	26	..	2·43
Kericho	76·27	71·18	26	5·09	..

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